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ABSTRACT

This report organizes findings of an exploration of changing job skills in Virginia which combined the points of view of various analysts with information provided by employers. Part One contains some background material: a brief history of occupations in Virginia, a description of recent trends, an explanation of the mechanisms that bring about occupational change, and summary of how the study was carried out. Part Two groups related occupations into 10 clusters, each including an introduction, a description of what the literature and interviews said about each occupation, and a general conclusion about the occupational group. Part Three summarizes what employers said about trends and changing job skills in the workplace. Six interrelated trends are identified: required skills are becoming more technical, computers are an important tool, occupations are becoming more specialized, teamwork is becoming more important, employers are becoming more client- and customer-oriented, and the pace of change is rapid. Part Four summarizes what employers said about their successes and failures in communicating training needs to educators and their suggestions for improving communication. Part Five summarizes the study and gives recommendations for enhancing training for changing job skills and employer-educator communications in Virginia. (YLB)

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CHANGING JOB SKILLS IN VIRGINIA

The Employer's View

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The data for this study came from personal interviews with 115 employers in Virginia. Many of these people took more than an hour out of their busy schedules to share their ideas with us, and without their generosity, the study simply would not have been possible. Although their names and affiliations are confidential and consequently we cannot acknowledge them by name, we sincerely thank them for their responsiveness, candor, and encouragement.

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During the last 25 years, important social, economic, and technological changes have all contributed to the position in which Virginia's employers, educators, and labor force find themselves today. The economy's shift to concentration in the service sector, the information revolution, new electronic technology, and changing social attitudes have all played their part, until today, Virginia's economy bears little resemblance to the agrarian economy of its founding at Jamestown, more than 350 years ago.

In 1985, Virginians are in the midst of a period of rapid technological change that has affected all areas of our lives, and nowhere have we felt this change more than in the jobs we hold and the skills we need to do them. This study explores what employers in the private and public sector think about such change: how it has affected the occupations in their organizations, firms, and establishments; the new skills they want their employees to have; the training these skills require; and how communications between employers and educators might be improved to help the Commonwealth's work force adapt to these new requirements.

Our discussions with employers led us to identify six major interrelated trends in the work place of today. The first two are technological: first, the general skills we require of our workers are growing more technical, and second, computers in particular have become an important tool throughout the occupational spectrum. Third, largely as a result of the proliferation of technology, occupations are becoming more specialized.

But the work force is also being affected by other developments. The fourth trend we identified is the increasing organization of workers into teams in which each specialized employee plays a part, and the fifth is the increasing orientation of employers toward client and customer relations. Increased competition is one of the economic forces behind this change; another is reorganization that stems from changing technology and results in such developments as vendors who maintain and repair the complex machines they sell, transforming the person who carries out these functions into a front-line contact with customers.

The sixth and final trend in the work force will surprise very few: the pace of change is rapid, so rapid that sometimes training for skills cannot keep up with employers' needs. But much as we might like to, we cannot really forecast the future. Occupations and the skills they entail change at different rates and in different ways. Many occupations have changed a great deal in the last 25 years. Some have already undergone most of the change employers expect; some will undergo more. Some have scarcely changed at all but probably will begin to change soon; some will not. And always there remains the possibility that new technological change of a kind we cannot now imagine will create whole new industries, new occupations to staff them, and new training needs for their employees, just as the electronic technology has done during the past few decades.

Whatever the future brings, our talks with employers indicated that the six trends already in progress have produced changing skill requirements in four areas. Basic skills have been expanded to include new emphases on reading and understanding technical materials and on oral communication. The need for interpersonal skills has expanded as a result of the need for teamwork and for employees to project a favorable image of the organization they represent. As the computer—in one form or another—pervades the work place, computer skills, including an understanding of how the machine and its logic works, become important to increasing numbers of workers. As the new technology expands and change continues, employees must be able to generalize from past experience to new experience, and reasoning, generalizing, adaptability, and flexibility become important across the occupational spectrum.

The degree to which employers have tried to communicate these needs to educators varies. Many employers are satisfied with the quality of the job applicant pool and see no need for such a dialogue. Others remain unaware that opportunities to do so exist, and still others believe that educators would be unresponsive to their suggestions. However, among employers who have made the effort, most are satisfied with the result, finding that even when educators are unable to meet their needs completely, communication can still be rewarding. Employers are particularly pleased with the one-on-one contacts they have had and with internship and cooperative education programs that combine classroom instruction with a real-world hands-on approach to training.

From what we read about the future of occupations, and even more importantly, from what employers told us, a number of recommendations emerged. In regard to training, we believe that basic education could profit from enhancement in four areas. Instruction in reading and interpreting diagrams, charts, and other technical materials would be of value to students whose future occupations may range from automobile mechanic to electronic engineer. Increased emphasis on communications skills, stressing clarity and correctness of both written and oral presentations, would be of similar widespread use. Today's students cannot begin too early to acquire familiarity with computers, not only with how to operate them but also, on a general level, how they work, because only this kind of acquaintance can prepare them to use this multipurpose tool the way employers want them to—creatively and efficiently. Interpersonal skills—among them, personal presentation, courtesy, sensitivity to others, and conflict management—are valued by employers across the occupational spectrum and are also among the skills most difficult to find in job applicants. Although most of the skills in these four areas are being taught somewhere in Virginia's educational system, their importance to employers indicates that they need to be taught widely and early if the needs of the work force are to be met.

Because so many employers told us they were unaware of the established mechanisms for communicating these needs to educators, our initial recommendation in this area is for wider dissemination of information about the advisory boards, councils, and committees currently in place. But even though some employers who had used these mechanisms spoke highly of the experience, and those who used other channels often expressed considerable satisfaction, employers felt strongly that the initiative should be taken by educators, and this constitutes another of our recommendations. Moreover, given the success of informal contact between employers and educators, we recommend that the importance of such contacts be recognized and fostered. In a more formal setting, employers' enthusiasm for the contacts facilitated by internships and cooperative education lead us also to recommend increasing the numbers of such programs and expanding them into new areas wherever possible.

Finally, our conversations with employers led us to believe they do not expect job applicants to come equipped with every skill they need; in fact, many employers offer extensive on-the-job training and intend to continue doing so. Instead, employers want to hire people who are able and willing to learn, who can communicate and relate to co-workers and the public, and who can be trusted to represent the employer well to the public. In a time of rapid change, they value the skills that enable people to be adaptable, flexible, and able to keep pace with further change throughout their working lives.

PART ONE

Background: Virginia's Changing Job Skills

"As the economy robotizes and domestic jobs are lost to foreign production, 10 million to 15 million manufacturing workers and a similar number of service workers likely will be displaced from their existing jobs. Much of this displacement will occur in the mid- to late 1980s."
—Pat Choate, Retooling the American Work Force. Northeast-Midwest Institute

"[T]he application of as many as 150,000 industrial robots will not support cataclysmic employment impacts, either in terms of job creation or job displacement. It is not reasonable to think that 1.5 million technicians are needed to maintain 150,000 robots, nor is it reasonable to suppose that 150,000 robots will displace millions of workers."
—H. Allan Hunt and Timothy L. Hunt, Human Resource Implications of Robotics. W.E. Upjohn Institute for Employment Research

In 1985, Virginians are in the midst of a period of rapid technological change that affects every area of our lives, from artificial conception techniques that have revolutionized the way life begins to heart transplants that extend its duration. No matter how we are born or how we die, technological change has had an enormous effect on the way we spend the years between, particularly on our jobs and the skills they require. Moreover, this change is so rapid that we are sometimes not even aware of it until after it has occurred—or after it has passed us by.

Anticipating the effect of occupational change in the years ahead is particularly difficult because technological change is so rapid and so pervasive. The two statements that open this report are examples of how widely analysts can differ when they try to predict the future of work in America. The real future probably lies somewhere between the two extremes, but it may also lie in a different direction altogether.

However, whether we think life at the turn of the century will be much the same or vastly different, there is general agreement that the nature of many occupations has already changed, and further change continues to occur. New tasks are being added, requiring new skills, while other tasks are being eliminated, making old skills obsolete. In the office, secretaries use word processors and microcomputers instead of typewriters, making corrections to documents in less than half the time it took before. In the laboratory, engineers design robots that will replace people on assembly lines but will create new jobs for robot mechanics. In the automobile repair shop, mechanics use computers to diagnose problems and set idling levels of cars equipped with electronic gauges and fuel injection systems.

In this study we explore changing job skills in Virginia, combining the points of view of various analysts with information employers gave us. We set out to answer four questions:

- What jobs will be needed most during the next decade, and which of them will involve changing job skills?
- What skills do employers require for these jobs now, and how do they expect these requirements to change?
- What kinds of training and background do employers require for these jobs now? How will these change?
- How have employers communicated their needs to educators, how successful have their efforts been, and how do they think communication between employers and educators might be facilitated?

To find the answers, we read as widely as we could and consulted experts as often as we were able, but most of all we talked to employers. Some of these employers were in firms or agencies employing hundreds, sometimes thousands, of people. Some were in establishments employing two or three. The employers were located all over the Commonwealth, in Northern Virginia, Danville, Roanoke and Tidewater, and many places between.

This report organizes our findings into five sections. The first section contains some background material: a brief history of occupations in Virginia, a description of recent trends, an explanation of the mechanisms that bring about occupational change, and a summary of how this study was carried out. The second section groups related occupations into ten clusters, each including an introduction, a description of what our reading and our interviews told us about each occupation, and—except for one miscellaneous cluster—a general conclusion about the occupational group. In the third section we summarize what employers told us about trends and changing job skills in the work place, and in the fourth, what they told us about their successes and failures in communicating their training needs to educators and their suggestions for improving communication. The fifth and last section then summarizes the study and gives our recommendations for enhancing training for changing job skills and employer-educator communications in Virginia.

Virginia's Labor Force:

A Brief History

Virginia's first settlers found an abundance of natural resources. Rich soils and a favorable climate enabled them to cultivate a variety of crops. Besides raising food and livestock for their own consumption, Virginians grew wheat, cotton, and tobacco for export to Europe and to other colonies. Forests provided lumber, rivers supplied drinking water, and both rivers and ocean provided fish as well. It is no wonder, then, that in colonial times Virginia was an agrarian society.

Dependence on agriculture, however, had its drawbacks. Especially in the seventeenth and eighteenth centuries, farmers could do little to prevent crop losses resulting from weather, insects, and other acts of nature. In colonial times, English economic policies restricted the markets farmers could use, required them to ship in English vessels at higher rates than merchant seamen of other countries charged, and levied high import taxes and an English merchant's commission on the sale of Virginia's major money crop, tobacco.

Nonetheless, agriculture also had advantages. Growing tobacco was as lucrative as mining gold, yielding a far greater return on labor than manufacturing could. It was cheaper to import manufactured goods from Europe and pay in tobacco, and the English parliament discouraged and even prohibited the development of manufacturing in the colonies. And in addition, Virginians preferred the lifestyle that accompanied farming.

The Commonwealth's industrial development really began with ironworks and munitions manufacturing in support of the revolution against England. After independence, Virginia's farmers began to seek out new markets in Latin America, and small industries including sawmills, mines, and ironworks began to flourish in the western part of the State. By mid-nineteenth century, the tobacco manufacturing industry had been established, with its center in Richmond. Flour mills sprang up along the falls of Virginia's numerous rivers; smaller manufacturers made whiskey, paper, rope, and textiles; and mining continued across the state, from salt, lead, and coal in the Southwest to gold in the Piedmont, granite in the Richmond area, and iron in the Northwest.

At mid-century, one of the most useful new industries was transportation, beginning with the port at Hampton roads, which linked the Atlantic Ocean with inland settlements as far north and west as Richmond, Washington, D.C., and Baltimore. By the middle of the 1800's, canals extended the waterway system inland, railroads were introduced, and together these forms of transportation began to change both the industrial and occupational structure of the state. Construction jobs came first—clearing rail beds, laying rails, and digging canals. Soon after came jobs in railroad operations and in the inns and lodging houses that proliferated along the new routes. Finally, with better transportation leading to increased commerce, bankers and businessmen were needed to finance and manage expanding trade.

As a result, when the first shots of the Civil War were fired in 1861, Virginia's economy, while still chiefly agrarian, was more balanced than in colonial times. After Appomattox, however, the plantation system broke up, and the nature of agriculture in Virginia changed. The abolition of slavery eliminated cheap labor, and a world-wide depression made it impossible for many of the great landowners to keep their farms. Labor-intensive crops such as cotton and tobacco became more expensive to cultivate, especially on land that had been depleted by generations of farming. Other crops were developed: vegetables on the Eastern Shore, peanuts—and hams from the pigs that fed on them—in Southside, and fruits on both the eastern and western slopes of the Blue Ridge. At the same time, the industries that had arisen before the war slowly began to recover.

By the early part of the twentieth century, a number of changes had taken place in Virginia's economy and consequently in its occupational structure. Improvements in transportation played a triple role in these developments, by providing more jobs in the transportation industry itself, supporting further industrial development, and encouraging urbanization. Although Virginians still worked in agriculture, forestry, and the industries built around them, they found jobs in new areas as well. In addition to working in coal mines, cotton mills, shipyards, and plants that manufactured cigarettes, they now worked in establishments that produced pulp and paper, furniture, and synthetic fibers; and where town life existed, they worked in schools, hospitals, stores, and police departments.

The First World War brought an expansion of Virginia's shipbuilding industry, but with the end of the war and the ensuing depression, this industry all but collapsed. With the outbreak of the Second World War, Virginia's industrial expansion began in earnest. On the coast, shipbuilding resumed, employing engineers, drafters, skilled workers, and laborers. In northern Virginia, expansion of federal agencies in both the Commonwealth and the District of Columbia offered white collar and military jobs. In the small city of Radford, a new munitions plant employed 20,000 people. Throughout the State, construction activity flourished, while schools, police departments, utilities, and other services struggled to keep up with the demands of a growing population.

The period following World War II was also a prosperous one for Virginia, and by the 1950's, the general structure of today's labor force had emerged. Along the Blue Ridge Mountains and in Colonial Williamsburg, the growing tourist industry offered jobs for park rangers, guides, hotel managers, chefs, waiters and waitresses, and many more. In the southwestern part of the State, the lumber and coal industries were important sources of employment. Manufacturing—largely located in the east and south—had expanded to include synthetic fibers, food products, and chemicals, providing blue collar jobs. Government expansion—federal in northern Virginia and state in

Richmond—employed increasing numbers of people in clerical, managerial, and professional occupations. As a result of all this expansion and the population growth that accompanied it, the service sector also expanded. Job opportunities became available in banks, insurance companies, schools, hairdressing establishments, and many other places that provided either business or personal service.

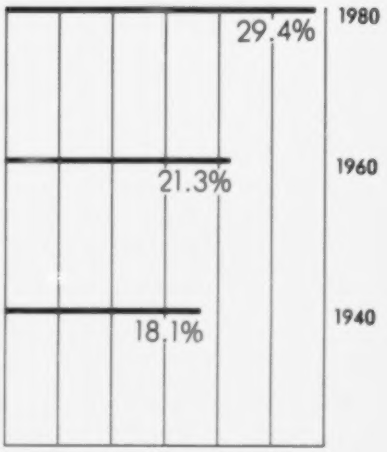
Some 350 years after Jamestown was settled, the agrarian society of Captain John Smith had evolved into a diverse industrial structure, and in response, Virginia's labor force had evolved from a colony of farmers into the diversified and skilled work force it is today.

The Last 25 Years

Beginning in 1960, two important and interrelated developments produced far-reaching changes in the occupational structure of Virginia as they did in the entire nation: the shift to a service economy and what is often called the information revolution. In the mid-1980's, they are still in progress and as a result, business, industry, education, and the labor force face new challenges in their attempt to adapt to increasingly rapid technological change in a new environment.

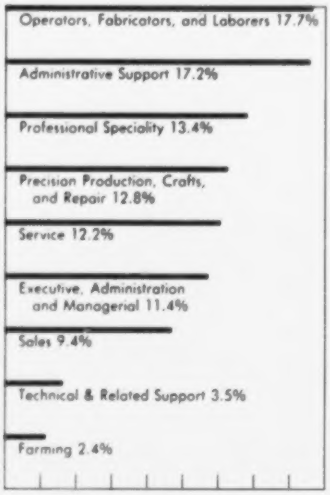
Service industries do what their name implies: they provide businesses and people with services, from banking to health care to protection of property. Figure 1 illustrates the magnitude of Virginia's shift to a service economy. In 1940, 18 percent of the Commonwealth's work force was employed in service industries. By 1960, this had risen to 21 percent, and by 1980 almost a third of the work force was employed in the service sector. There were several reasons for this shift. In the growing economy of the 1950's, economic services expanded in response to demand, and personal services expanded in response to growing populations and increased affluence. During the next decade, competition from foreign manufacturers spawned service industries as well. Corporations began to withdraw their investments from domestic manufacturing and reinvest abroad, requiring a network of business services to help manage their farflung enterprises, and entrepreneurs began to channel their activity away from manufacturing and toward the expanding service sector.

Figure 1.
Percent Employed in Virginia's Service Industries, 1940-80



The information revolution—increasing reliance of our economy on creating, transmitting, storing, retrieving, and using information—was closely related to the emergence of the service economy. Many of the diverse occupations that became more and more important in the service economy depend on gathering, storing, and exchanging information. In turn, the increasing need for information has both accelerated and been accelerated by electronic technology. Although most people believe this technology is still in its in-

Figure 2.
Virginia's Labor Force, 1980



fancy, it has already radically changed some occupations—clerical work, for example. Because information can be transmitted faster than ever before, industries that depend on data have been quick to adopt the new technology. New service industries have emerged to support it—data processing services, computer repair services, and the like—and they are staffed by people whose occupational titles were unfamiliar as recently as 30 years ago—data entry keyers, computer operators, programmers, and systems analysts.

The 1980 Census of Population indicates that at the beginning of this decade, Virginia's occupational distribution was similar to the nation's. Almost a quarter of all Virginians worked in executive, administrative, and managerial occupations. Technical and administrative support occupations employed about a fifth, and slightly under 10 percent worked in sales. Together, these occupations, which make up the traditional white collar segment of the labor force, employed over half of the Commonwealth's labor force. Blue collar occupations, both skilled and unskilled, accounted for just over 30 percent, with only about two percent in farming.

These people work for a variety of industries, many of them concentrated in Virginia's metropolitan areas. The federal government, for example, is the Commonwealth's largest employer of secretaries, typists, and specialized clerks, accounting for a considerable proportion of the clerical workers in northern Virginia. State government employs large numbers of typists and file clerks. Engineers work for the federal government in northern Virginia and at the naval shipyard in Tidewater. Computer programmers and operators, systems analysts, and data processing machine repairers are employed by service industries whose clients are largely metropolitan. Health care workers are similarly concentrated because metropolitan areas contain large hospitals and numbers of patients, and since retail trade tends to locate near customers, sales workers are also clustered in metropolitan areas.

Other industries are located in particular parts of the State. Shipbuilding is largely confined to the Tidewater-Peninsula area and consequently so are shipfitters. Manufacture of electric and electronic components, employing electric/electronic assemblers, is found in several areas but is concentrated in northern Virginia. Most of the State's correction facilities and mental hospitals—the major employers of corrections officers and psychiatric aides—are located in rural counties in western or southern Virginia.

Still other industries are found throughout the Commonwealth. School systems that employ teachers; automobile dealers and repair shops that employ automobile mechanics; and local governments that employ police are examples. Nor does concentration in metropolitan areas imply that workers are not to be found elsewhere. Although the majority of health care workers are found in metropolitan areas, small hospitals, nursing homes, and doctors' offices are located in all parts of the State, and consequently so are the people they employ. Colleges and universities, employing people in every major occupational category, are another example, with two of the state's largest universities and several of its colleges located in rural counties or small cities.

As a result, changing job skills are a challenge in every part of Virginia. It may be that desktop computers are more often found in the offices of metropolitan insurance agents than in rural ones, but that will not remain the case for long. Change tends to begin and take place most rapidly in metropolitan areas, but it spreads. Occupational change is not confined to Virginia's largest cities, nor is the need for changing occupational skills and for new kinds of learning and training that will provide present and future workers with these skills.

How Occupational Change Comes About

History indicates that in Virginia, as in other states, occupational change is a constant process with many causes. We have seen how in the past, social, economic, and technological change all played a part in this process and how all were interrelated. A closer look at these mechanisms may help to explain our current situation and the outlook for the future.

Social and Economic Change

In a free society, social and economic change are frequently inseparable, each a cause and effect of the other. Moreover, the democratic system guarantees that legislation will respond to these changes, sometimes enhancing, sometimes mitigating their effects. Occupations and their associated skills are part of this system and consequently part of its changes. This section will examine social and economic changes that have led to some of the changing job skills that we will look at more closely later on.

Among the major changes that have affected the occupational structure of Virginia—and the nation as a whole—are the shift to a service economy, the increase in the number of women in the labor force, the aging of the population, and the trend toward deregulation of the economy. Some of these have affected occupations directly, some indirectly. Occasionally one change has directly affected one occupation. More often, however, these changes have acted simultaneously.

The increased importance of service industries to Virginia's economy is one of these changes. In service industries, skills in communications and human relations are vital for success. They are, in effect, the service industry's stock in trade, so much so that employers often value them more highly than technical skills. The head of one engineering consulting firm, for example, told us that in his firm personality and effective communication skills were more important hiring criteria than engineering competence.

Child care, for example, is a service industry that is being influenced by social and economic factors. First, a number of social and economic changes encouraged the entrance or re-entrance of women into the labor force. These included the rise of feminism, the increase in the number of families headed by women, and economic conditions that made two incomes a necessity for many families. The rising proportion of working women in turn increased the demand for child care services, and the industry began to expand.

At the same time, the child care industry itself began to feel the impact of social and economic change, including increasing affluence among those who use child care services, increasing emphasis on pre-school education, and most recently, evidence of serious problems with child abuse and neglect. As a result, consumers of child care services have begun to demand that the people who staff these facilities be professionally qualified. Responding to this demand, a segment of the industry now employs people with Associate, Bachelor's, and even Master's degrees in child development, pre-school education, and similar fields. State certification requirements for facilities that care for six or more children are undergoing review, and some child care workers themselves are in favor of higher educational requirements that might upgrade salaries. Some employers and parents oppose these changes because higher salaries will increase costs that will be passed on to consumers in the form of higher fees: employers fear being priced out of the market; consumers fear being unable to afford services they need. The outcome is still in doubt, but the combined effects of social and economic factors on both the formal and informal skill requirements of child care workers are plain.

Banking is another field that is responding to such changes. In banking, the impetus for changing the job skills required of tellers originates from a change in national policy toward deregulation and increased emphasis on the free market economy. This change in policy, which itself reflects changing attitudes, has been embodied in legislation that permits a range of institutions to offer services that previously could be offered only by banks. As a result, banks are now facing a many-fold increase in competition. They must now actively seek to sell their services, and the logical people to do this are their tellers, who have the most frequent and direct contact with customers. Consequently, bank tellers are increasingly being asked to become sufficiently familiar with the bank's services to recommend them appropriately, persuade the customer to take advantage of these services, and do this in a pleasant, friendly, and accommodating manner. Some banks have even instituted incentive programs for tellers, rewarding them for carrying out these tasks well. In other words, as a result of national changes in political attitudes, consequent changes in policy, and resulting legislation, tellers in some of Virginia's banks are now required to be salespeople as well as tellers, acquiring, in the process, skills they never needed before.

Technological Change

Technology—whatever its nature—exists within a social and economic structure and interacts with that structure. Technological change, for example, often develops as a response to economic competition, as a way of producing better products more cheaply, or of meeting new consumer demands. Technological change also affects society, and one of its major effects is occupational change. Recently, technological change has been occurring at a rapid pace throughout the labor force, resulting in widespread change in the occupational structure and skills required of Virginia's workers.

"Technology," however, is seldom clearly defined. It is often used solely to mean high technology, conjuring up images of space-age environments in which everything is computerized, sterile, and streamlined, and where all the workers wear white coats. In this study, however, technology is a much broader term. We use the word "technology" to refer to the tools that are used to do a job, and the term "technological change" to indicate any change in these tools.

In the real world of work, technology is as likely to consist of a monkey wrench and a screwdriver as an electron beam welder or a computer. Therefore, almost all occupations involve some use of technology, though its importance to each occupation varies. At one extreme, engineers use sophisticated technology to design even more sophisticated technology. In the more common case, nurses, welders, and typists use technology to expedite their work but are seldom if ever involved in designing or modifying it. And at the other extreme, most psychiatric aides and child care workers make little use of technology in the ordinary course of their work.

Changing technology can affect occupations in several ways. First, large-scale changes can create new industries and occupations. The computer industry is a recent example. Innovations in computer technology made the microcomputer possible, introducing new companies to manufacture and market the product. In turn, a host of subsidiary industries has arisen to manufacture and market all kinds of microcomputer accessories—printers, floppy disk drives, and specialized furniture, among others—as well as software to enable the computer to carry out functions ranging from playing chess to projecting three-dimensional views of newly-designed mechanical devices. The range of occupations directly created or substantially altered by these developments includes electronic engineers, technicians, assemblers, programmers, wholesale and retail sales people, repairers, and many others.

Such a major development also has indirect effects. In occupations that use the new technology, skill requirements are often altered. In some cases, new technology is simply a tool that makes the job easier or allows it to be done better but does not really require new skills. For example, automobile mechanics now use computers to diagnose problems, set idling levels, and the like, but using these new tools requires a minimum of skill. The skills required for secretarial work, however, have changed considerably. Secretaries must learn to master electronic word processors, become familiar with electronic filing systems, and in some cases learn to use microcomputer programs for budgeting and other calculations. In other occupations, certain skills have been rendered obsolete. For example, bookkeepers who use computers no longer have to perform calculations by hand.

Technological change can also result in the need for new skills in nontechnological areas. Office machine repairers are an example. As office machines have become more expensive and complicated, companies increasingly sell service contracts along with the product. As a result, office machine repairers are often employees of the vendor, and vendors have found that consumers want repairers who can not only fix the machine but also suggest improvements and instruct them in its use. Office machine repairers therefore need two new skills. First, the new office machines are electronic rather than mechanical, so that the skills involved in repairing them are different from the old ones. Second, the repairer has become a representative of the company, involved not only in repair, but also in customer relations and sales.

Major technological change can also reduce the number of workers needed in some jobs, and even—in a few cases—eliminate the jobs altogether. Computer technology created the job of keypunch operator, the person who operated the machine that produced punched cards for input to mainframe computers. Changes in computer technology have now all but eliminated this occupation and replaced keypunch operators with data entry keyers, who enter data directly into the computer from computer terminals.

In this case, most of the keypunch operators whose jobs have been eliminated can be retrained quickly and easily to be data entry keyers, and since the demand for data entry keyers is expected to be high, few jobs will actually be lost. In the case of welders, however, the situation is different. In some kinds of welding, robots have begun to replace human welders. While some welders may be able to continue on the job, monitoring the robots, it is likely that many will be displaced because the skills needed to program and repair the robots are very different from those needed in welding.

However, it would be a considerable mistake to think that technological change spreads at an equal pace through all industries and occupations, or even from establishment to establishment within industries. Not all the jobs that welders do can currently be done by robots, and not all the plants that could use robots actually have them. Similarly, the cost of converting the record-keeping system of a large government agency to an electronic data storage and retrieval system can be so enormous that years after most small private offices have acquired microcomputers, the large agency's file clerks are still handling paper.

Finally, technological change can alter the whole way in which work is done. Some people believe that once computer technology has achieved maturity, many workers will not need to spend all of their working time at the work place. The "electronic cottage" will then reunite work place and home, with consequent widespread effects on the nature of supervision, scheduling, and the quality of work life in general. If this happens, the world of work, in Virginia and elsewhere, will change considerably but not overnight. Some occupations will be affected immediately and directly, others more slowly and indirectly. For instance, some data entry keyers already work at home, linked to the employing establishment by a computer terminal and a telephone line, but it will be a while before so many people work this way that the number of office buildings is reduced and demand for the janitors who maintain them falls.

Sometime in the future, the electronic cottage may well be the norm, and the resulting revolution will be comparable to the one that originally separated the work place from the home. That change, the one we call the Industrial Revolution, did not occur all at once either, but the outcome was as different from what went before as the electronic cottage would be from what we experience now. In the meantime, however, economic, social, and technological factors have combined to place us in a time of transition and rapid change that affects employees, employers, and educators alike.

Changing Job Skills and Changing Training

Social, economic, and technological change make up a set of interrelated factors that work together, with change in one component often producing change in the others. This change may take many forms, and an important one is change in the configuration of occupations and the skills they require.

The degree to which an occupation changes can vary, and consequently, so can the degree of change in the skills that it requires. At one end of the spectrum, a new skill may be simple to learn: a cashier usually learns to operate a new cash register in an hour or so. At the other end of the spectrum, the new skills may be completely different from the old ones: a typewriter repairer who needs to learn to repair word processors requires complete retraining.

Skill change that requires a few hours of training occurs frequently, rarely causes serious problems, and attracts little public attention. Change that eliminates jobs altogether occurs infrequently, often causes serious problems, and commands much public attention. Most skill change, however, falls somewhere between the two extremes, creating change significant enough that workers are—at least informally—trained in new skills but not so significant that it produces immediate major dislocations in the work force. Different degrees of skill change obviously call for different training strategies.

Another important factor in training for new skills is who is being trained. Whether the trainee is a labor force entrant or someone already employed makes a difference to everyone concerned. In the most common cases, where changing skill requirements moderately affect the occupation, employers often expect people who are already employed to acquire the new skills on the job, but they want new employees to come onto the job already equipped.

Training on the Job

To train their workers in new job skills, employers use a variety of strategies. Self-instruction, short in-house training courses, training provided by the manufacturers of new equipment, and courses in community colleges or other outside facilities are all ways in which workers acquire new skills.

Where new equipment is designed for one particular purpose, this kind of training usually succeeds. For example, experienced repairers can often successfully learn to work with new machinery through a combination of short courses and service manuals provided by the manufacturer.

In many cases, however, this approach is only partially successful. For example, although many of the skills needed to operate the new electronic technology can be learned quickly, using this technology to its fullest advantage often requires additional understanding of how it works and what its capacities are. Thus, a bookkeeper may learn the basics of using a computer spreadsheet in a few hours, but for most people, learning to use it efficiently—*"making it stand up and do tricks,"* as one employer put it—is another matter. Some people may acquire this ability from experience, but many never do. Nor are the effects of incomplete training always obvious. The new system may be used, but not efficiently; yet often no one knows this, because no one has been trained to understand the full capacity of the equipment. In a large organization, the number of times this happens can add up to a considerable loss in time, money, and competitive advantage.

The need to develop or improve interpersonal skills can also pose a training problem. This almost universal need affects a range of occupations from automobile mechanics, who must communicate more skillfully with increasingly sophisticated customers, to engineers, who are increasingly required to sell the services of the firms for which they work. Yet human relations is an area in which formal training is usually unavailable and employers lack the expertise to provide on-the-job training.

Training New Workers

Many employers expect to provide a certain amount of on-the-job training. The knowledge required to repair machines and equipment, for example, is specific to the brands and types a particular establishment uses. In these cases, employers expect to train new employees on their own equipment, either in house or at facilities offered by the manufacturer. This is also the case in some other occupations where specialization is the norm—engineering, for example—and also where employers provide complete on-the-job training, in apprenticeship programs, for example.

However, where extensive on-the-job training is not the norm but skill requirements have changed, employers want to hire people who already have the skills they need. In an automated office, for example, an employer may be willing to train a secretary to use a particular brand of word processor or microcomputer but will expect a job applicant to be familiar with electronic word processing in general. As a result, education for the job market needs to incorporate new skills as quickly and comprehensively as possible. Employers need these skills, and so do labor force entrants.

Rising Educational Requirements

Another response to the demands of changing job skills is upgrading the educational requirements of a job. This can happen as a result of factors external to the employer. The government can mandate and/or consumers can demand higher educational levels; both of these factors are currently affecting child care work, for example. Sometimes new skill requirements can only be taught at higher educational levels; computer programming is moving in this direction now. At present, many programmers do not have college degrees, but employers are increasingly demanding that programmers have expertise in the fields in which they work—accounting, for example—as well as in writing software. If this demand is to be met, programmers will need higher educational credentials.

In other cases, educational requirements are upgraded unnecessarily. For example, many employers seem to believe either that people who go to college are the kind of people who have innate interpersonal skills, or that the college experience teaches these skills. Whatever the mechanism, they perceive the college graduate as likely to be more personable and better able to project a good image for the company. The result can be a degree requirement for an occupation in which the skills could more efficiently be taught at a lower educational level. In turn, not only does the occupation become more inaccessible to people who cannot afford or do not want to attend college, but also the applicant pool decreases. Both these factors can force salaries, and therefore employers' costs, upward.

It was with all these problems in mind that we undertook this study of changing job skills and training in Virginia. Before we begin to describe what employers told us about this area, we will close our introductory section with a description of how the study was done.

How the Study Was Done

This report summarizes the results of 250 interviews of employers in 115 private firms and public agencies around the State. We asked these employers what tasks their employees did; what educational backgrounds they came from; what the formal requirements for the jobs were; what skills and personal characteristics employers looked for when they hired people; and whether it was difficult to find people who met these criteria. We also asked about change—whether these jobs had been affected by change, technological or otherwise; whether adjusting to change had been a problem; and what kinds of changes employers expected to take place in the future. Finally, we asked whether employers had ever tried to communicate their needs to educators. If they had not tried, we asked them why not, and if they had, we asked whether they thought their efforts had been successful. In either case, we asked them to recommend ways in which such communication could be facilitated and improved.

In this section of our report we describe first how we went about choosing these occupations, selecting the employers, and conducting the interviews, and second, what we believe to be the limitations of the study.

Choosing the Occupations

This study focused on occupations that met two basic criteria: first, they had to be important in Virginia, and second, they had to involve changing job skills. The initial step, then, was to decide what occupations would be important during the next decade or more.

Occupational importance can be judged in a number of ways. Sometimes, the criterion is the occupation's rate of growth, but this can be misleading if the base is small. For example, in 1980, 175 Virginians worked as archivists and curators. Had this occupation been projected to grow by 100 percent during the ensuing 10 years, there would still be only 350 archivists and curators by 1990, hardly an impressive number. On the other hand, an occupation can employ tens of thousands of people and be projected to decline, but even so may provide employment for significant numbers of people who must be trained in the skills it requires.

Our approach was to select occupations that were projected to have an average of 140 or more openings per year between 1980 and 1990 as indicated by the Occupational Employment Statistics projections for Virginia. These projections are produced by the Virginia Employment Commission and include only openings that result from two factors: first, the creation of new jobs (growth), and second, people leaving the labor force (separations). They do not include openings that result when people leave one job to take a different one. Thus the projections of openings are conservative ones.

Having selected these occupations, we ranked them, producing a list of the 110 occupations that were projected to have the most openings. Since our interest was in occupations that involved changing job skills, our next step was to collect information about the present and future skill requirements of these occupations, by reviewing literature and often by talking informally with employers. As a result of this process, we eliminated some occupations that are projected to employ large numbers of people but are not likely to involve changing skills. Two examples of such occupations are janitors and cashiers. In both these cases, the equipment that workers use has changed and will probably do so again within the next 10 years. However, employers assured us that the changes were minor. Workers could learn to use the equipment in a matter of hours at most, and little change was foreseen in skills, personal characteristics, or training requirements. We also eliminated a few occupations, such as school administrators, that required graduate degrees or considerable work experience.

The remaining occupations were those that were projected to employ significant numbers of people, and that we had reason to believe would involve sufficient skill change to warrant studying. Not all of them turned out to involve a great deal of skill change, but a large majority did. These are the occupations that are described in Part II of this report and on which our conclusions are based. They are projected to account for 28 percent of Virginia's wage and salary labor force by 1990 and are listed in the Appendix.

Selecting the Interviewees

Both the time frame of the study and the resources we had available restricted the number of interviews we could conduct. At the same time, we believed that it was important to interview both small and large employers and to obtain as diverse a geographic sample as we could.

These restrictions precluded drawing the sample statistically, though statistical methods were incorporated wherever possible. The sampling procedure consisted of three steps. The first step was identifying the industries that employed the most workers in each occupation. To do this, we used an industrial-occupational matrix provided by the Virginia Employment Commission. This matrix included 405 industry groups, almost all in the private sector.

The second step in sampling was identifying a random selection of firms in each industry, using procedures as close to statistically valid ones as possible in order to stratify by size and location of firm. For this step we used three categories of size—under 20 employees, between 20 and 100, and over 100—and eight geographic areas—the Northern Virginia, Richmond-Petersburg, Norfolk-Virginia Beach-Newport News, Danville, Roanoke, Lynchburg, and Charlottesville metropolitan areas, and the balance of the State. Although statistical methods would have required us to draw one firm of each type from each size category in each location, this was not possible. Sometimes no firm in the proper size class appeared in the matrix. For example, we were not able to locate a doctor's office that employed more than 20 people. Sometimes one kind of industry was geographically concentrated. Shipbuilders, for example, are difficult to find in Danville, and textile and apparel firms are largely absent from Northern Virginia. Despite these difficulties, we conducted at least three interviews for each occupation in a minimum of two different industries, size classes, and locations.

The final step in selecting interviewees was determining whether the agency or firm would speak with us; if so, whom we should talk to; and if not, selecting an alternate interviewing site. Generally, we first contacted the personnel director or proprietor by letter and followed up with a telephone call. If the response was favorable—as 90 percent were—the interviewer set up an appointment by telephone, asking to speak with the person directly in charge of the employees in the occupation about which we were asking. These people ranged from personnel directors to supervisors to—in very small firms—the person who actually worked in the occupation.

Developing the Questionnaire

Simultaneously, we were developing the interview itself. As a first step, we developed a prototype interview that was circulated for comments to our advisory committee. This prototype was also used by each interviewer to do two practice interviews locally. We used the advice we received from both these groups to revise the interview into its final form.

Our aim in conducting these interviews was twofold: to get accurate information and to make the person we were talking with comfortable enough to speculate freely on the future of the occupations. Some parts of the interview were therefore structured, but most questions were open-ended. The interviewers, who were all members of the staff of Tayloe Murphy Institute, were well acquainted with the goals of the study and thus able to carry out the interview on a more informal basis than might otherwise have been the case. In general, employers were extraordinarily generous with their time and thoughts. In the midst of their busy schedules, many spent over an hour with our interviewers, and we hope that their experience was a pleasant one. Since confidentiality prevents us from listing either the people who spoke to us or their agencies, firms, or organizations, we would like to take this opportunity to thank them publicly for their valuable cooperation.

Limitations of the Study

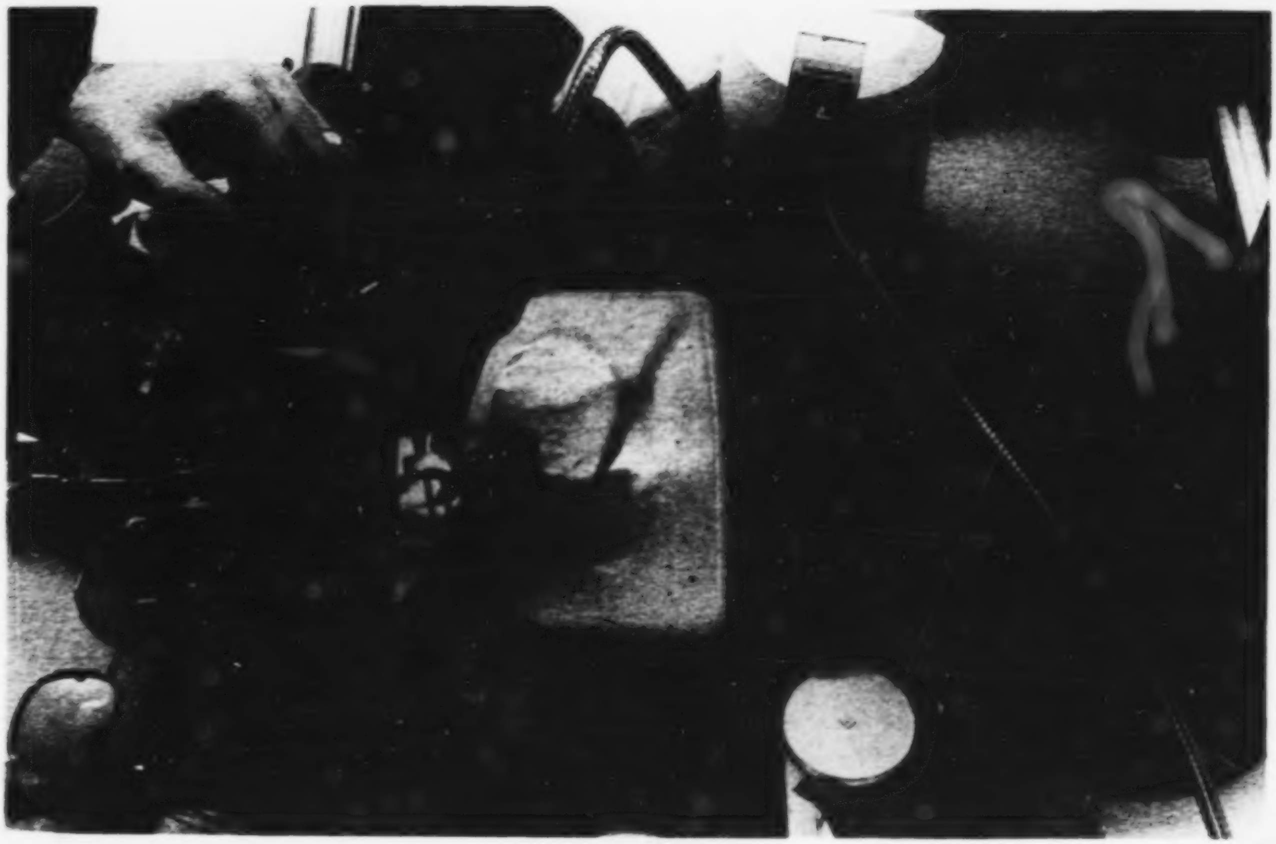
The major limitations of the study lie in three areas: first, the occupations that were included; second, the amount of information we were able to collect about each; and third, the perspective from which the study was done.

The occupations included in this study are probably not the only occupations that will be important in the future. For example, the self-employed and several other broad groups, including most managers and all sales workers, were excluded from our sample. In the case of the self-employed, projections are not available. In the case of managers, sales workers, and several other occupations, many of them in the service sector, the occupational classification scheme used for the projections groups these occupations so broadly that it is impossible to distinguish one kind of manager or sales worker from another in any way that would have been useful to us.

For those occupations we included, the amount of information we were able to gather varies. We conducted a minimum of three interviews for each occupation; for many we conducted six or seven. Often we supplemented the formal interviews with expert consultations, talking with people in state agencies, universities, and other institutions that train and/or employ people in those occupations. Sometimes we consulted with people who worked in the actual occupation as well. In addition, we read as widely as we could in current literature about occupational futures, both general and specific.

However, we had neither the time nor the resources to read in depth about each occupation in the study. While we consulted a variety of government publications and other materials that contained capsulized information on the occupations, we believe that extensive reading in textbooks for teaching occupational skills, trade journals, and other specialized materials might have given us additional insight.

Finally, the purpose of this study was to gather information about changing job skills from the employer's point of view. We seldom interviewed employees or educators, each of whose perspectives are important to a truly comprehensive view of the subject. We hope that the people who use this study will bear these limitations in mind, and that future research in the area of changing job skills will enable both wider and more intensive coverage of this important topic.



Occupations with Changing Job Skills

This part of our report summarizes what employers said about each of the occupations that we identified as having job skills that have recently changed, are presently changing, or are expected to change in the near future. The occupations are divided into ten clusters. The first nine are presented in order of the average number of openings projected to occur in these occupations each year, and within each cluster, occupations are also arranged according to this criterion. A tenth cluster consists of eight miscellaneous occupations that could not be logically grouped in any other way.

The introduction to each occupational cluster begins with a table containing data from the Occupational Employment Statistics (OES) Survey carried out on a three-year cycle by the Virginia Employment Commission. These data include 1980 employment, projected 1990 employment, 1980-90 numeric and percent change, and projected average annual openings—the sum of openings projected to occur as a result of growth in the field and those expected to occur as a result of people leaving the labor force.

The OES projections are based on trends in the recent past and assume that industrial staffing patterns and other factors will remain stable until 1990. They are therefore likely to be more accurate for occupations that are changing slowly than for those that are changing rapidly. In addition, OES projections do not include the self-employed, and consequently the projections for occupations where self-employment is a possibility—child care workers and electricians, for example—are conservative.

These statistics yield some interesting facts about the occupations in our study:

- The largest occupation is teaching, from kindergarten through secondary school; the second largest is secretarial work. Both these occupations are traditionally held by women.

- The largest cluster of occupations is people who work in offices, a subset of clerical occupations. These occupations are projected to grow the most between 1980 and 1990; however, they are not projected to grow the fastest.

- The fastest-growing occupations, according to the OES projections, will be those directly related to computers, including the people who repair, operate, and program them. This cluster is projected to grow more than twice as fast as all wage and salary employment in the State.

- With a projected growth rate of 177 percent, data processing machine repair is expected to be the fastest-growing occupation in the study, but it will offer only 225 annual openings compared to over 4,700 each in secretarial work and nursing.

- Although office work will increase the most of any cluster, one office occupation, stenography, is the slowest growing of all; and although computer-related occupations are the fastest-growing, one of them, keypunch operator, has all but disappeared already. Both these developments are the result of changing technology and illustrate the impact of rapid change in these areas.

Taken together, the occupations in these clusters employed 574,359 Virginians in 1980. Excluding data entry keyers and hospital pharmacists, for whom projections are not available, the OES projections indicate that by 1990 these occupations will employ about 173,700 additional people. Consequently, at least 28 percent of all civilian Virginians employed by industry and government will work in occupations in which changing job skills are a significant factor.

General Office Occupations

	Employment		1980-90 Change		
Occupation	1980	Projected 1990	Numeric	Percent	Average Annual Openings
Secretaries	59,087	80,715	21,628	37.0	4,749
Typists	28,728	34,651	5,923	21.0	1,711
Receptionists	12,492	16,681	4,189	34.0	724
Clerical Supervisors	11,307	13,889	2,582	23.0	640
File Clerks	6,433	7,895	1,462	23.0	387
Stenographers	7,533	7,572	39	1.0	300
Total	125,580	161,403	35,823	29.0	8,511

As distinct from specialized clerks, people in office occupations work in general offices, where they usually deal with transmitting, generating, storing, and retrieving many different kinds of information. These less specialized occupations often require a wide range of skills, but none requires more than a high school diploma. All are jobs traditionally held by women, with pay scales that are relatively low.

In office occupations, the size of the organization in which the person works often determines the degree to which the functions of each job overlap. In small establishments, all the occupations described in this section, plus others—such as bookkeeper—may be combined into a single job. In large ones, each of the occupations may itself be divided into specialties or, as in many state and federal systems, into grade levels. In such systems, tasks grow more skilled and the work calls for more responsibility as the grade level within the occupation increases.

People who work in offices are found throughout Virginia, in both the public and private sectors, and in virtually every industry. In 1980, over 125,500 Virginians held jobs in this category, a number that is expected to increase by nearly 36,000 by the end of the decade. Positions for secretaries are projected to increase the most, but taken together, growth and separations from the labor force will produce over 8,500 openings per year for people who work in these six occupations. Even stenography, projected to add only 39 positions between 1980 and 1990, will experience sufficient numbers of labor force separations to provide about 300 jobs each year.

Secretaries

Employers listed so many tasks to be carried out by their secretaries, and these tasks varied so widely, that any overall definition of the occupation would be misleading. In fact, secretaries seem to share only three general tasks: word processing—using a typewriter, a word processor, a computer, or any combination of these; answering telephones; and filing. However, if there are any secretaries whose duties are limited to these tasks, this study did not encounter them. Some of the additional tasks listed were taking dictation, either personally or using a dictaphone; dealing with the public—in person, over the telephone, or in correspondence; billing and bookkeeping; compiling legal documents for an employer who is an attorney; supervising and training lower-level clerks; setting up and coordinating meetings; and even writing speeches. Overall, secretaries tend more to be jacks-of-all-trades and/or personal assistants than clerical workers in the more limited sense of the term.

Employers usually cited general high school as the most common educational background for their secretaries, though in one federal agency the most common background was private trade and technical schools. In terms of educational requirements, however, they disagreed. Some said that they had no educational requirement and would hire anyone able to type at a certain speed. Others require a high school diploma. None actually required more education than this, but several mentioned an increase in the number of college graduates seeking secretarial positions. In addition, most employers preferred that a job candidate have some experience, though few were ready to specify exactly how much.

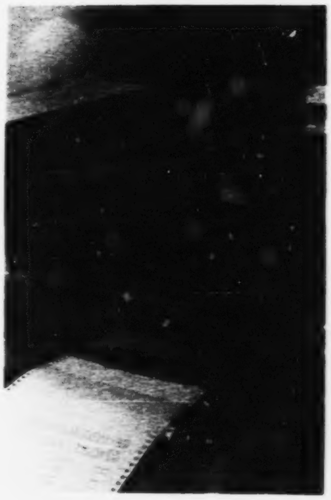
Despite the range of tasks that employers require of secretaries, they generally agree on the skills and characteristics they would like to see in a successful job applicant. Interestingly enough, only one of these is technical. This is the ability to type, and it is also the only ability on which employers disagree. Preferred typing speed ranged from 35 words per minute, ordinarily considered slow, to 65 to 75 words per minute. What might be called semi-technical skills included attention to detail and accuracy, while personal characteristics included dependability, the ability to work independently and under pressure, organizational ability, and the capacity to communicate with the public.

Given the amount of variation among secretarial jobs, it is probably not surprising that employers did not agree about whether they have trouble finding good candidates for these positions. In state and federal government agencies, for example, most of the secretarial openings are filled by promoting typists or clerk-typists. Thus the applicant pool is prescreened, and there is little difficulty in filling the slots.

Where problems exist, they tend to be of two types, the first relating to technical skills, the second to personal characteristics. First, although most employers are willing to offer in-house training in operating electronic equipment, they prefer some experience on such equipment and have difficulty finding such people. On the other hand, some jobs—particularly those in state government—are classified in categories that require stenographic skills that are difficult to find, even when these skills are seldom used on the job.

Second, some employers had a less obvious problem in finding good applicants for secretarial positions. Particularly in a small office, where the relationship between a secretary and an employer is more likely to be on a one-to-one basis, personality characteristics and "fit" are important, and finding a person with both the right skills and the right personality can be a problem.

Secretarial work has already been heavily affected by the new electronic technologies. Except in one single-person office, all the employers we talked to mentioned the conversion from typewriters to word processors, and most cited electronic communications, and/or computerized scheduling, billing, and filing. One employer, whose business combines the positions of secretary and customer service representative, said that employees already spend 40 to 50 percent of their time operating electronic equipment, a percentage that is expected to increase to between 80 and 90 in the future. In some offices this is seen as simply a change from one kind of equipment to another, and not as a factor that actually changes the nature of the job. However, most employers felt that this change has resulted in upgrading the job, since secretaries are now being asked to perform more as assistants, working independently and taking on added responsibility.



This transition is still in progress. In most cases, employers made it clear that the conversion from manual to electronic processes would continue. At this point, most are still willing to hire secretaries who are not familiar with electronic equipment and to provide training in its use. However, in the future employers will be looking for secretaries who have been trained to use word processors and are also familiar with computerized billing and filing procedures. They believe that such training should be provided before a candidate enters the job market. For people who have these skills, one employer said, *"it will be an employee's market."*

Moreover, most employers said that by the year 2000 they expect secretarial work to have changed radically. Many said that secretaries as we know them now will be obsolete, but opinions about the future nature of the job varied. For example, there was general agreement that the number of positions available for legal secretaries will be significantly reduced. On the one hand, many lawyers already prefer to compose on word processing equipment themselves, reducing the amount of time a secretary spends on correspondence and other non-technical documents. On the other hand, the growth in numbers of paralegals has resulted in fewer demands that secretaries serve as legal assistants. As a consequence, both the amount and scope of the work that legal secretaries have traditionally done are being reduced. In the future, employers say, it is likely that several attorneys will share a secretary, significantly reducing the number of such positions.

Employers in other fields also believe that secretarial work will undergo radical change. Either the job will be split among a variety of specialists—information processors, data entry keyers, and production control technicians, for example—or secretaries will perform comparatively few clerical duties and many more administrative and semi-professional tasks. Whether this results in elimination of the job title entirely or in radical change of its content, there appears to be general agreement that the kind of secretary we are now familiar with will hardly exist.

Typists

In many agencies and organizations, some or all of the people who are reported as typists are in fact secretaries. For example, the Virginia state government classification system contains several grades of clerk-typist, but these are actually secretarial positions that do not involve stenographic skills rather than positions in which the duties are limited to processing words.

In other environments, however, typists and secretaries perform very different functions. In general, typists concentrate more heavily than secretaries on word processing, perform fewer other tasks, and have no administrative responsibilities. Depending on the kind of place in which they work, they may type manuscripts, general correspondence, administrative documents, statistical tables, technical materials, or a combination of any or all of these.

A typist must, of course, be able to type, but most employers would like some other skills as well. *"It would be nice,"* one supervisor said somewhat wistfully, *"if they knew how to read and spell"*; nor was this the only statement of its kind. Apparently most employers are not satisfied with typists who merely reproduce material letter-for-letter and word-for-word. In fact, in addition to reading and spelling, employers also indicated a general need for a knowledge of grammar and composition, as well as a feel for numbers.

In candidates for an entry-level job like typing, where many have just graduated from high school, these skills seem to be difficult to find. It is clear that prospective employers do not always consider job candidates' language preparation adequate. Where technology has penetrated the organization, employers also want job candidates who are more familiar than most with word processors and other electronic equipment. In response to these deficiencies, one employer stated a preference for community college graduates who had taken courses in college-level English. This employer also stressed that candidates should be sufficiently acquainted with word processors to take advantage of the more sophisticated features of these machines.

Among the employers with whom we talked, there was nearly unanimous agreement that the typewriter will be all but obsolete by the year 2000, replaced entirely by the electronic word processor, but this change is not seen as a great one. Although the kind of equipment will change, and eventually the name of the job may change too, employers will continue to want good work attitudes, accuracy, attention to detail, and a knowledge of grammar and spelling along with familiarity with the basic tool of the trade.

One organization in which we interviewed was already as highly automated as most predicted they would be in the next 15 years. Thus some of the information we received in this agency is of particular interest. In this environment, no typist spends more than half time working on a typewriter. Not only do all typists use word processors, but the word processors are programmable, and the typists are expected to be familiar with this phase of their operation. In addition, this highly automated office uses Kurtzweil machines, optical scanners that both read and type material. As a result, there is less word processing for people to do, and in addition to their other tasks, most typists act as data input keyers as well. As a consequence, it is useful for a typist to have some mathematical ability as well as a basic knowledge of automated systems. This means that a typist in this organization, entering with these qualifications and undergoing on-the-job training on a number of advanced electronic machines, is eminently promotable. It then becomes difficult not only to find good candidates for the position but to keep them once they are hired and trained.

Receptionists

The basic task of a receptionist is greeting and directing visitors. People categorized as switchboard operators/receptionists combine this task with that of routing calls and taking messages, but both jobs include other tasks as well. Most receptionists of either kind do some filing and light typing, and many who are not officially receptionists/switchboard operators do in fact operate telephone equipment and take messages. Other duties can range from taking payments in a professional office to clipping newspaper articles relevant to the employer's business to answering routine mail. In one establishment a single person served as switchboard operator/receptionist, assistant office manager, and part-time payroll clerk.

Most employers do not require that receptionists have prior experience or specific training, though some in the medical field may prefer job candidates with some background in that area. More importantly, employers stress that the receptionist is the first-line contact between the employer and clients or customers. Therefore, personality factors are considered an important qualification. While most employers consider a high school diploma or its equivalent to be sufficient education, they are unanimous in wanting a receptionist to project a positive attitude, respond well to pressure, and be good at handling people. In some offices, medical ones in particular, the receptionist's job may include first-line management of people who are distraught.

In addition, as one respondent pointed out, even though the receptionist is extremely important for good public relations, the position is likely to be the lowest paid in the office. Similarly, another respondent pointed out that in an organization that was undergoing considerable change, it was likely to be the receptionist—as the lowest-ranked person—who bore the brunt of people's tensions and anxieties. Given these demands, as well as those that result from having to deal with more than one telephone call or person at a time, it is not surprising that one skill mentioned by many employers is the capacity to avoid becoming easily flustered.

However, despite a list of qualifications that can sometimes sound formidable, most employers feel that good candidates for the position are generally available. In fact, one person we spoke to had 200 responses to a newspaper advertisement of a single vacancy. Nor do employers expect technology to change the job very much. Though a receptionist may already have electronic equipment at the reception desk—a personal computer, a terminal, or a new telephone system—using such equipment is not seen to require any new and complex skills. The exception is the small office in which the receptionist position involves a variety of tasks, including the use of a microcomputer to do word processing or data base management.

The one area in which employers perceive a change in the requirements for a good receptionist is public relations. In dentistry and hospitals, for example, competition is increasing, and with increased competition comes the need to make patient-receptionist contacts as smooth and pleasant as possible and to make sure that the receptionist does everything possible to accommodate the patient. Rather than requiring new skills, this need will emphasize interpersonal skills even further.

Clerical Supervisors

Clerical supervisors, like other office clerical workers, do not constitute a discrete group. Many secretaries, for example, supervise other clerical workers while continuing to provide support services for one or more supervisors of their own. Clerical supervisors, however, are people whose primary duty is to supervise other clerical workers.

As might be expected, the larger the firm or agency, the more likely the clerical supervisor to devote a large proportion of time solely to the supervisory function. This function includes some formal decision-making: setting work priorities, organizing the work flow, and evaluating performance. Generally the supervisor is also responsible for training new employees, interpreting company or agency policy to both new and old workers, signing leave slips, and the like. In other words, the clerical supervisor is the bridge between the administrative and/or managerial level and the clerical level, and since the occupant of the position usually performs at least some of the duties of those being supervised, a major requirement of the job is the ability to balance two sets of expectations that are sometimes in conflict.

As one employer pointed out, the dual nature of this job can also lead to difficulties in finding job candidates. The clerical supervisor position is not an entry-level one. It actually requires two sets of skills, technical and managerial. If the position is filled by promotion from within, as most seem to be, the candidate is likely to have the technical skills but not the managerial ones. On the other hand, filling the position by hiring a manager can mean that the candidate lacks the technical skills needed to perform the part of the job that is clerical rather than supervisory. Consequently, this employer suggested that formal training programs in the clerical area teach something about management as well as such skills as typing, filing, word processing, and the like.

This dichotomy, and by implication the need for training, also emerged from our discussions in other ways. Management skills required of a clerical supervisor—*"people skills,"* as one employer called them—include the characteristics needed to set an example for others. In order to be promotable into the supervisory level, a candidate should be dedicated, hard-working, and reliable. In addition, however, employers want a clerical supervisor to have a positive attitude, be flexible and intuitive, be able to see the overall company picture, and work well with others. One employer also mentioned that a clerical supervisor needs to be able to *"walk a fine line between being a friend and a co-worker and a supervisor,"* the logical result of both having been promoted from within and doing some of the same work as those being supervised.

File Clerks

A file clerk stores and retrieves records of all sorts upon request, usually according to a system set up by someone else. Traditionally, these records have been printed documents. Although people in most other clerical occupations also do some filing, file clerks spend most or all of their time at this task.

Employers generally do not have an absolute minimum educational requirement for file clerks, although they prefer a high school graduate or someone with a General Education Development certificate (GED). Beyond this level, no special formal training is required. Training is done on the job and is idiosyncratic in the sense that each office is likely to have its own system.

The most basic requirement for file clerks is literacy in terms of both words and numbers. A file clerk should be able to read and arrange materials both alphabetically and in numerical sequence. Beyond these basic skills, what counts is attitude and personality, including dependability, willingness, honesty, good personal hygiene, and the capacity for repetitious work. Because the job pool for file clerk positions is large, employers do not have difficulty finding people to meet their requirements.

However, employers have some doubt that there will be many file clerks 15 years from now. Most, though not all, believe that with increasing computerization the job of file clerk as it is now will not exist. There will continue to be jobs in basic information storage and retrieval, but these tasks will be performed by a computerized system. Data storage will be accomplished by entering information into a computer, and retrieval will involve running software that finds and displays the information. Thus this entry-level, basically unskilled job is expected to be largely, if not wholly, replaced by one that requires a higher degree of literacy and the ability to follow a more complex set of instructions. Such a changed job will require a higher skill level than it does now, and employers expect these skills to be acquired in high school. Many who now do not absolutely require a high school diploma expect to do so sometime within the next 15 years.

Stenographers

Stenography as a separate occupation seems to have largely disappeared. Originally, there were two kinds of stenographers. One worked in a pool, similar to the way some typists and word processors work now. A person requiring such services would then be allotted a stenographer from the pool. Although undoubtedly some stenographic pools still exist, none of the employers we talked to maintained such pools. The second kind of stenographer is really a secretary who also takes personal dictation.

Although the number of employers who dictate is decreasing rapidly—and most who still dictate use a machine—some government classification systems continue to rank secretaries with stenographic skills higher than those without them. However, employers see the demand for such skills falling to zero by the end of this century. In the meantime, general high school, high school vocational education programs, and private trade and technical schools are the sources of job candidates with stenographic skills. However, most of these candidates will actually hold secretarial positions and should have the skills needed for this kind of work if they are to compete successfully for a job.

Office Summary

Because offices are places in which information is processed, it is not surprising that office occupations are among those most heavily affected by the new electronic technology. In both small and large offices, the tools of the trade are no longer the typewriter and the ledger, but the computer terminal, the microcomputer, and the word processor.

The degree to which this change has brought about a need for new skills is, however, a more complicated question than one might think. It is really a question with two parts: first, to what degree are new skills required in order to operate the new tools efficiently; and second, to what degree will the new technology give rise to new tasks?

The first question is easier to answer. Operating electronic equipment in the office involves a new set of skills. Because electronic equipment offers a much wider variety of options than the typewriter, the operator must learn what these options are as well as the commands required to invoke them. In addition, general knowledge of how the machines operate increases the efficiency with which they can be used. Such knowledge can be put to use in a number of ways, but perhaps foremost among them is the ability to generalize knowledge about how to operate one kind of a machine to operating another kind. Unlike typewriters, different brands and types of electronic equipment vary in the commands they use. The basic technology, however, is the same. Consequently, a person who knows what the machine actually does in response to a command can more easily select the analogous but different command on another machine without undergoing a great deal of retraining. This is particularly important because many of the manuals that accompany this equipment are both difficult to interpret and incomplete. This general knowledge also makes it possible to use word processing programs—whether on a word processor or a microcomputer—to their fullest capacity, enabling the operator to devise ways of accomplishing tasks that might not be altogether obvious to one who relies more on rote training than on understanding.

The second question is whether the new tools will produce any other changes in the level of skills required of people who work in offices. Opinions about this differ. On the one hand, some people believe the new technology will reduce the level of overall skills. It has been suggested, for example, that using computerized spelling checkers means that a secretary need no longer be concerned with either accuracy or spelling. On the other hand, some people anticipate that new equipment will be so efficient that it will reduce the time a secretary spends doing tasks that require relatively low levels of skill. The result, these people say, will be the transformation of a secretary into a personal assistant, concerned with a much broader range of administrative tasks than is now the case and greatly increasing the level of skills required for the job.

Our study produced little evidence that the electronic office decreases skill levels. In fact, the employers with whom we talked believe the opposite. In small offices, where clerical workers perform a variety of tasks, each of them may entail new skills. In the larger organization, where greater occupational specialization is the rule, the picture is somewhat different, but it also includes a requirement for more rather than fewer skills. In these firms, office workers are generally more specialized, but the technology is also likely to be more complex. Here, there is some evidence that the electronic office may reduce specialization. For example, where typewriters and keypunch machines have been replaced by a single piece of equipment, the computer terminal or microcomputer, the skill requirements of the typist and the data entry clerk begin to overlap. Both enter words and numbers into the machine, and it becomes efficient to combine the two functions.

However, large organizations sometimes have more rigid job classification systems than smaller ones, and these regulations can reduce the organization's capacity to reassign tasks so as to maximize efficiency. This is particularly true because these classification systems are often quite old, and their revision is a major undertaking. Consequently, they sometimes specify obsolete skills and/or fail to take into account the need for new ones and the ways in which changing technology affects the content of the positions in the system.

In any case, the skill requirements of office jobs now include familiarity with computers. Whether they are present in the form of word processors, microcomputers, or terminals connected to a larger machine, or whether the change has already occurred or is projected to occur in the near future, employers want office workers to be acquainted with this kind of equipment. During this period of transition, many employers are willing to train people in house. However, as office workers gain experience with electronic equipment and these skills proliferate, and as more organizations convert to the new technology, job applicants will increasingly be expected to bring these skills with them when they enter the work force.

For many office workers, human relations skills are also becoming increasingly important. As employers confront more competition, the conduct of the secretary, receptionist, or switchboard operator can be an important factor in whether or not the potential customer, client, or patient will choose to do business with the employer. In a small office, all of the office workers may be in public contact positions at one time or another, and these skills may be important for everyone, whereas in a large organization, they may be required of only some. However, interpersonal skills are mentioned frequently enough to indicate that employers consider them important and look for them when they interview prospective employees.

Finally, although the new technology tends to decrease the number of workers required to do a task, the outlook for employment in this area remains positive because the number of offices is expected to increase considerably during the coming decade.

Health Care Occupations

	Employment		1980-90 Change		
Occupation	1980	Projected 1990	Numeric	Percent	Average Annual Openings
Registered Nurses	23,970	35,493	11,523	48.0	2,297
Nursing Attendants	19,286	28,281	8,995	47.0	1,787
Licensed Practical Nurses	10,522	14,873	4,351	41.0	961
Psychiatric Aides	8,041	11,491	3,450	43.0	709
Clinical Laboratory Technologists and Technicians	4,618	6,720	2,102	46.0	387
Medical Insurance Clerks	1,765	2,740	975	55.0	174
Pharmacists (1)	NA	NA	NA	NA	NA
Total (1)	68,202	99,598	31,396	46.0	6,315

(1) Figures for hospital pharmacists are unavailable.

The health care field contains many occupations, and those included here meet special criteria. First, they meet the requirements of the study: they employ relatively large numbers of people, and the skills they require are undergoing change. Second, they are specific to the field. Secretaries and bookkeepers, for example, are not included, even though many work in health care settings. Third, they are employed by organizations, rather than being self-employed. Finally, entry-level positions in these occupations require no more than a Bachelor's degree; in many cases, they require less.

In both type and complexity, the skills required for these occupations vary considerably. Most involve dealing with patients, but all the occupations require other skills as well. Some are primarily clerical, as in the case of medical insurance clerks. Some, such as clinical laboratory technologists and pharmacists, are primarily laboratory occupations. Some, such as registered nurses, involve technical, scientific, and administrative skills.

Most people in the health care field work in hospitals, clinics, or doctors' offices. For those who work in hospitals, occupational content varies according to whether the hospital is medically or psychiatrically oriented and whether it is an acute or chronic care facility. Increasing numbers of people, particularly nursing attendants and licensed practical nurses, also work in nursing homes, primarily with the elderly, and in the community.

Geographically, health care workers are found throughout the state, with heavy concentrations in major metropolitan areas. Not counting hospital pharmacists, in 1980 these occupations employed over 68,000 Virginians; by 1990 they are expected to employ nearly 103,000, with growth and separation providing about 6,300 openings each year. All six occupations for which projections are available are expected to show percentage increases well above the 24 percent increase expected for all wage and salary occupations. Indications are that registered nursing alone will offer almost 2,300 positions annually and that another 1,800 or so will be available to nursing attendants.

Registered Nurses

In the broadest sense, the primary duty of a registered nurse is caring for the sick, but the variety of settings in which the profession is employed and the variety of specialties within it make nursing an occupation with a wide range of duties. In addition to working in hospitals, nurses work in industrial settings, public health facilities, nursing homes, and schools, to mention a few. Within hospitals, some nurses work almost exclusively in administration, some care directly for patients on hospital floors or in emergency rooms, some work in operating rooms, and others work in other specialized capacities. Further, each of these categories often contains its own specializations. For example, nurses who work on hospital floors may specialize in one particular kind of patient—children, the elderly, or the new mother—or in a particular kind of disease or trauma—oncology nurses or those who staff burn units.

In addition, nurses who work in hospitals, nursing homes, and other organizations where there are other health care personnel almost always have supervisory duties. Such staffs ordinarily include licensed practical nurses, aides, and orderlies who receive their instructions from and report to registered nurses.

All registered nurses must be licensed by the State and must have undergone specialized training. Three different kinds of schools offer such training. First is the nursing school run by a hospital. The educational program at these schools usually lasts three years and culminates in a nursing diploma. Consequently, hospital-run schools are often known as diploma schools. Second, many community colleges have nursing programs leading to an Associate degree in nursing. These are usually two-year programs, though if they are done on a part-time basis the actual enrollment period may be longer than that. Third are nursing programs located in colleges and universities, usually taking four and sometimes five years to complete and leading to a Bachelor of Science degree.

Except in certain specialties or administrative work, employers do not seem to prefer any of these alternatives over the others. All nurses have learned basic nursing skills in school, where they have also gained clinical experience. Most of those trained in the past two decades have also had courses in related sciences, human relations, and psychology. However, the variety of capacities in which nurses serve makes it difficult to generalize about additional skills. For those whose jobs involve direct patient care, employers agree that a high level of interpersonal skills is required, including tact, patience, empathy, and reliability. Many nurses also need the ability to work as a member of a health care team, and those in administration may also need management skills.

Although some employers have problems finding nurses, these problems are not general. Shortages of good job candidates seem to occur in particular localities where there are many medical facilities and in particular fields of specialization.

Interestingly enough, nursing is not a field where new technology is usually the cause of much concern. Health technology has been changing rapidly for so many years, and in such radical ways, that such change is simply perceived as a normal part of the job. Ordinarily, either the company that manufactures new equipment or the organization in which it is used or both provide the required training in house and on a routine basis. As a result, in addition to their other skills, registered nurses also must be adaptable and flexible, as well as able to acquire new skills with ease and apply them with confidence. It is interesting to note that the only employer who cited difficulties with new technology was one who often hired nurses who were returning to the profession after an absence of some years.

Nursing, however, is a profession in flux in other ways. Like teachers, nurses are striving to increase their pay and to find recognition as a full-fledged profession. They have striven for and achieved more recognition from physicians and as a result are involved more than ever in decision-making on the patient's behalf. Some nurses who have taken additional training and obtained special certification work as nurse practitioners, handling virtually all aspects of patient care except directly prescribing drugs and therapies. In addition, a controversy currently exists among professional nurses about whether a Bachelor's degree should be required of all registered nurses, but this idea has so far not found favor with the state boards responsible for administering licensing procedures.

Nonetheless, nursing administrators foresee changes in the profession by the turn of the century. Some of these will come about because the trend toward outpatient care will increase. As a result, hospital nurses will work only with the most seriously ill patients, a situation that will require specialized skills, while nurses who work in the community will be increasingly responsible for independent decision-making in the home care environment. Other changes will result from nurses' own efforts to be accepted as full members of the health care team, exercising more judgment and working more independently. Some employers expect more direct patient care to be done by licensed practical nurses, with the majority of the registered nurse's efforts directed toward supervision and administration. Finally, along with increasing professionalism may come higher educational requirements, eliminating both the diploma and Associate degree options.

Nursing Attendants

Nursing attendants and aides work in all kinds of inpatient health facilities providing basic patient care. They perform such tasks as transporting patients within the facility, taking and recording temperatures and other vital signs, making beds, and helping patients with personal care. In nursing homes, they may also be responsible for monitoring the patients and reporting any changes or danger signs to their supervisors. In this setting they may also be involved in communicating with patients' families. Nursing attendants work under the supervision of registered and/or licensed practical nurses. They do not perform such tasks as administering medication and usually do not work directly with physicians.

Educational and training requirements for nursing attendants vary among institutions, but education beyond the high school level is not required. The Job Corps, private technical schools, and hospital schools are also common educational backgrounds for people in this occupation. In addition, attendants who work in nursing homes must be State certified by passing an approved course, usually at a public or private technical school. Some facilities require successful completion of this course before hiring; some allow people to complete the course after actually beginning work. Finally, some institutions give their nursing attendants on-the-job training in procedures or ways of doing things that are unique to the institution.

Employers want nursing attendants to have personal characteristics of two types. First, because they work closely with patients, attendants should care about others and be emotionally mature themselves. Second, employers stress that nursing attendants should be personally neat and clean, punctual, reliable, and able to follow orders. A certain amount of physical strength is also required, since many attendants perform such tasks as turning patients in bed and transferring them from bed to chair.

Most employers say they do not have trouble finding these characteristics in job applicants, but they mention the need to screen applicants carefully. In addition, employers' emphasis on good work habits, grooming, and cooperativeness suggests that many applicants lack these qualifications; but because the applicant pool is so large, there is no shortage of people to fill these jobs. The only shortage was mentioned by one employer who had problems finding enough men to fill jobs calling for male attendants.

Employers agreed that nursing attendant jobs have not been greatly affected by either technological or nontechnological change and are unlikely to be so affected in the future. One employer had taught attendants to administer electrocardiograms; another cited increased opportunities for attendants to participate in the planning and organization of the facility. Mainly, however, the duties of the job are expected to remain the same.

Disagreement about the future centers, therefore, on the need for nursing attendants rather than on what they will do. Opinions range from *"someone will always have to be around to deliver basic care to human beings"* all the way to *"gradually, there will be none . . . [T]heir jobs are now being done by LPN's [licensed practical nurses] and RN's [registered nurses]."* In between are employers who believe that the number of attendants will be reduced, and that they will increasingly perform their tasks outside health facilities, in such jobs as home health aide.

Licensed Practical Nurses

The duties of licensed practical nurses (LPN's) overlap those of the nursing attendants who rank below them and the registered nurses who rank above them. The extent of this overlap varies among and within the facilities in which they work. In nursing homes, for example, there are often few distinctions between the duties of licensed and registered nurses, though there are some tasks, such as the review of patients' medication charts, that licensed practical nurses usually cannot perform. In addition, in large hospitals where there are nursing administrators of various sorts, these positions are held by registered rather than by licensed practical nurses.

Licensed practical nurses must have two years of high school and have received additional training in a specialized program for LPN's. Such programs are offered in public schools, community colleges, hospitals, and private technical schools. The prospective nurse must then pass a state examination leading to certification.

All employers of LPN's require such certification, but the degree of on-the-job training offered varies among institutions, some of which train the licensed practical nurse in fully half the tasks to be performed, others of which provide no training at all. Required experience is also variable, but no employer mentioned more than one year's supervised experience as a prerequisite for being hired.

Since the duties of licensed practical nurses bridge those of nursing attendants and registered nurses, it is not surprising that employers look for a corresponding mixture of personal characteristics. On the one hand, LPN's and nursing attendants share such requirements as neatness, responsibility, and dependability, while in the case of registered nurses, these qualities are assumed and therefore rarely specified. On the other hand, LPN's are expected to exhibit levels of self-awareness, interpersonal skills, and an attitude of concern and caring that are more like those required of registered nurses than of nursing attendants.

The determining factor in whether employers have trouble finding good applicants for these positions seems to be the local balance of supply and demand. At one extreme are areas with relatively few medical facilities and a local training program for LPN's; at the other are areas with many medical facilities and relatively few local training programs. The major difficulty in finding good applicants was expressed by an employer of temporary private duty nurses, a job that requires a somewhat specialized mix of responsibility, accountability to the home agency as well as to the patient, and the capacity to deal successfully with a variety of circumstances and types of people.

Changes in medical technology affect licensed practical nurses, particularly those who must instruct and supervise patients in operating equipment newly designed to function in the home environment. However, an even greater recent effect has resulted from the development at some institutions of new training programs in special procedures that were formerly beyond the scope of LPN training. Whether these programs are offered, and whether the LPN actually performs these procedures is up to the facility in which they work. However, many facilities have opted to expand the range of the LPN's tasks to be almost the same as those of registered nurses. This means that many LPN's must take courses in such fields as intravenous and oxygen therapy.

In addition to increased technological skills, the job of the licensed practical nurse has changed in other ways as well. In hospitals, for example, employers mentioned a new emphasis on public relations—both LPN's and RN's acting as representatives of the hospital both when caring for the patient and when serving at such community functions as health fairs and screening projects. In nursing homes and in home health care, duties have expanded even further. One employer summarized this situation: *"Nurses in [patients'] homes are responsible for things they didn't used to be: being a liaison between a patient and family, and the physician and hospital. Sometimes they're the only contact with the patient, so they have to pick up any problems. They're also in the role of patient advocate, [and] need to help people be informed about care. Sometimes they act as social workers, identifying problems like the patient not having any food, or psychological problems in the family. Then they have to know to contact someone and get extra help."*

Employers had different opinions on the future of licensed practical nursing. On the one hand, some were doubtful about its prospects. They pointed out that the pay and prestige of the job are low, yet many of the duties are identical to those of registered nurses, who draw higher salaries. Most employers felt that as a consequence licensed practical nursing would not continue indefinitely as a separate job, but would either merge upward into the RN classification or downward into the nursing assistant one. It is likely that both will happen. Given that the duties of an LPN already overlap those of the other two occupations, it seems likely that the more enterprising among prospective LPN's will choose to become RN's instead, while the others become nursing attendants.

On the other hand, as one employer pointed out, licensed practical nurses are at present cost effective. They do much of the work of registered nurses at a lower rate of pay, and this alone may ensure their survival in the foreseeable future. In this case, training programs will have to change to keep pace with expanding duties and higher skill levels. Employers are already looking for such changes and giving preference to job applicants who have taken the courses they need to be certified to administer oxygen and intravenous therapies. In the future, those who employ licensed practical nurses will be looking for even more.

Psychiatric Aides

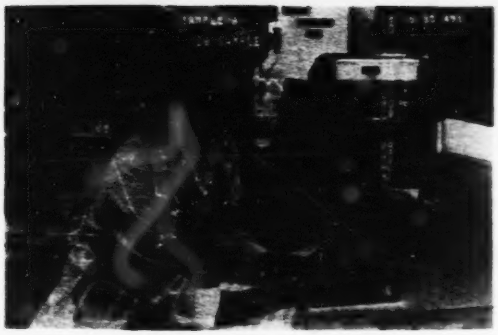
Psychiatric aides work in psychiatric hospitals or on the psychiatric wards of general hospitals, providing basic care to patients. They perform their work under the supervision of the nursing staff. In some situations, aides have relatively little involvement in decision-making or input into the patient's treatment. In others, particularly private psychiatric hospitals, they may be acknowledged members of the treatment team, participating in planning for the unit in which they work, attending in-service meetings, and providing nurses with information relevant to treatment plans.

In still other settings, the two levels of duties pertain to different occupational titles, psychiatric aide and psychiatric technician. Aides do the more basic duties, helping patients with hygiene and personal care, giving limited nursing care, orienting patients to the unit, assisting with physicals, and so forth. Where the two jobs are differentiated, technicians then perform the more responsible tasks, initiating admissions procedures, making rounds with psychiatrists, documenting observations of the patients, and participating in staff case meetings.

Some of the variation in how psychiatric aides function depends upon the quality of the applicant pool as well as the kind of institution. In some smaller areas where the population is highly educated, employers say there is a large pool of well-qualified applicants, many with Bachelor's degrees. In such cases there is a tendency to upgrade the job in order to make use of the talents such people offer. In these areas preference is given to job candidates with college degrees, and even to those with previous experience in human services jobs. In other areas, the applicant pool is less educated, and employers find it difficult to attract applicants with good work records and the requisite personal characteristics.

These characteristics, in fact, also vary. Where aides are used simply to carry out nurses' orders and provide basic care, employers want people who will come to work on time, follow instructions, and get along with others. Where they perform a wider variety of tasks, employers assume good work habits and tend to look for such characteristics as flexibility, emotional stability, and a non-judgmental attitude toward mental illness, as well as self-esteem and assertiveness. In these cases, aides (or technicians, if the institution distinguishes between them) may also be required to be able to understand, accommodate to, and interpret the behaviors of people with different psychiatric illnesses. In fact, where most or all aides have at least one college degree, being able to work under the supervision of someone—a nurse, for example—who may have less education than the aide becomes a requirement of the job.

Regardless of these differences, psychiatric aides are first-line care people and as a result are little affected by technological change. Future expectations, however, differ by type of facility. Employers believe that in chronic care facilities—those providing long-term patient care—psychiatric aides will continue to be important. However, in acute care facilities there is some expectation that fewer psychiatric aides will be required. Two reasons are given for this. First, many acute care facilities are private hospitals, among which there is beginning to be considerable competition. In this environment, administrators believe that the public prefers care given by nurses to that given by aides. Second, the use of drug therapy in acute mental illness is expected not only to continue but to increase. Since psychiatric aides are not educated in this area, this change is also expected to lead to the employment of fewer aides and more nurses in the treatment of acute illness.



Clinical Laboratory Technologists and Technicians

Clinical laboratory technologists and technicians—sometimes called medical technologists and technicians—work in laboratories performing tests ordered by physicians on samples taken from patients. In addition, laboratory technicians are often the people who actually obtain the samples, for example, by drawing blood from patients. An experienced technologist may also oversee the operations of a laboratory, order supplies, and supervise others.

Formal requirements for clinical laboratory technicians differ from those of clinical laboratory technologists. Generally technicians must be high school graduates trained at a recognized laboratory school. Technologists, whose responsibilities are usually greater than those of technicians, must be college educated and have completed formal medical technology training from a school approved by the American Society of Clinical Pathologists. Some employers require technicians, technologists, or both to be ASCP certified or registered; some require only that they be eligible for certification or registration.

Lives can depend on performing tests correctly, interpreting their results, and reporting them accurately. Consequently employers require technologists to be precise and to have professional integrity. Even more, however, they mentioned the importance of interpersonal skills: concern and compassion for the patient, friendliness, and the ability to make people feel comfortable under trying and sometimes painful circumstances. Whether employers express problems in finding people with these qualities seems to depend mainly on whether they are located near a training source for technicians.

Technological change in hospital laboratories has meant not only increasing use of computers but also the advent of automated equipment. Employers mentioned two effects of this automation. First, *"high tech instrumentation is taking over work that a person—or three or four people—would have done."* Second, at least one employer felt that some acquaintance with electronics was becoming necessary to deal with the equipment. Further, the constant emergence of new equipment makes in-service training a necessity. Sometimes this training is fairly time-consuming, as in the case of week-long in-house seminars.

This trend is expected to continue, but employers differ about its implications. Opinions range from *"[there] probably won't be any medical technologists"* to *"technologists will recommend which tests to run."* In the first case, the expectation is that the job will be downgraded by technology, so that people who perform tests will be machine operators who do not need to know what the test is about or how it works. In the second case, even if performing tests will take less skill, technologists are expected to counter the trend by improving their position as resource people for physicians. Employers expect that the amount of information in the field of testing will expand beyond the physician's ability to keep track of it all and that the physician will then have to turn to the expert in the field as a resource.

Medical Insurance Clerks

Medical insurance clerks work in medical and dental offices as well as hospitals, where they process various kinds of insurance claims on behalf of patients. The tasks involved in the job combine bookkeeping, human relations, and bill collection. For example, a clerk may answer patients' questions about insurance coverage, help them fill out the appropriate form, submit the claim, do follow-ups with the insurance company, post payments, work with patients to get claims handled properly, and obtain payment of bills when necessary. Particularly in a small office, the insurance clerk may work only part-time or may spend only a limited number of hours per day handling insurance-related tasks while spending the remainder of the day as a bookkeeper, typist, or clerical supervisor.

The minimum education required for an insurance clerk is a high school diploma, with some employers requiring a two-year degree in accounting or business. Some also require experience, if not in the same job, at least in a related field such as credit collection. Where it exists at all, on-the-job training is informal and can range from self-training to instruction in how to fill out the forms and use the office computer system.

Employers want medical insurance clerks to be dependable and good with numbers, but more than anything else they need to be skilled in human relations. Insurance clerks must often deal with patients about sensitive subjects at a time when the patients are ill or emotionally upset or both. They should have the patience to explain insurance procedures, requirements, and forms several times, if necessary, and the tact needed to collect overdue fees without unduly disturbing the patient. However, a certain degree of assertiveness and firmness is required in dealing not only with the patient but also with the insurance company representative.

Recently, the jobs of most medical insurance clerks have changed in two ways. First is the arrival of computerized record-keeping. Second, insurance regulations and requirements are becoming steadily more complicated. Employers, however, do not regard these changes as major ones. Although most would now give preference to job candidates with some experience with computers, the basic requirements of the job have remained the same, and most employers expect little change in the future.

Hospital Pharmacists

Pharmacists are licensed practitioners who read physicians' prescriptions and orders, compound drugs and fill orders, manage and maintain records and inventories, and supervise pharmacy technicians. Pharmacy requires a five-year training period at an accredited school and an internship. Pharmacy schools generally award a Bachelor of Science in Pharmacy degree or, with two more years of training, a Doctor of Pharmacy.

Employers' requirements for pharmacists differ. Pharmacists must be licensed to be hired as such, but some employers will hire a person in the process of obtaining a license as a technician. Some require experience beyond the completion of the internship, but most do not; some provide extensive on-the-job training, some provide none. Generally employers agreed that a pharmacist's formal training should provide all necessary instruction but that this was not always the case.

Employers also stressed that as a result of significant changes in the nontechnical aspects of the job, pharmacists need extensive interpersonal skills. These are related to some significant changes in the nontechnical aspects of the job. According to employers, the pharmacist is increasingly becoming *"a part of the medical team." "With more new drugs coming out, the pharmacist is becoming the link with the physician—a data base for information on the new drugs." "[Pharmacists are] being heavily relied upon by doctors, since it's hard for doctors to keep up with the latest drugs and drug information."* In turn, many of the more routine functions of the job, such as inventory control and record-keeping, are being increasingly delegated to technicians.

As a result, pharmacists need to know how to deal with other members of the medical team as well as with patients. Employers want them to have a pleasing personality, a good public image, and the ability to work with others as part of a team, but also to be assertive. *"If a pharmacist disagrees with a doctor's orders, he or she should question them." "[It] used to be that the doctor was always right. But not any more."* Given the need to deal with doctors, nurses, and patients, one employer said, this is a *"person-oriented"* job.

This expansion of the pharmacist's job is relatively recent and has caused some problems. The main one is that *"professors [who teach pharmacists] are not practitioners,"* and that the interpersonal skills now required are not taught in pharmacy school. The job has also been heavily affected by the use of computers, mainly for records maintenance and inventory management, but skills in this area seem to be less difficult to find than interpersonal skills.

Employers agree that in the future the job of the pharmacist will be upgraded even further. The trend toward delegating routine work to technicians will continue, while pharmacists will become more involved in the clinical aspects of the job. The rapid proliferation of different kinds of drugs, and the need to know how they function in combination, as well as conditions under which they should or should not be used, mean that pharmacists will become the drug experts. They will become responsible for training others, and their position on the medical team will gain increasing importance.

Health Summary

For two reasons, recent and future change in health-related occupations is difficult to summarize. First, this field contains many occupations, involving a range of educational requirements and job tasks. Second, there is considerable disagreement about the future of some of these occupations, especially in the nursing field.

For some time now, constant technological change has been a factor in most health service occupations. As a result, such change is not as much of a problem as it is in some other fields. In the higher-level health care occupations, such as registered nursing and hospital pharmacy, training in the use of new devices is usually offered on an in-service basis and is simply a requirement of the job. At the lower levels, where the most basic patient care is provided, such as nursing attendants and psychiatric aides, technological change has not been a factor, nor do employers expect its emergence in the near future.

The nursing field in particular is in the process of change, and it is still not clear where this change will lead. For some time, registered nurses in hospitals have been increasingly involved in supervision and administration. Recently, nurses with Bachelor's degrees have also moved toward efforts to define a role that includes greater participation in making decisions about patient treatment and care, while delegating direct care duties to diploma nurses who have graduated from hospital schools and Associate degree nurses who have graduated from community college programs. Nurses' professional associations have been particularly active in this area.

This redefinition is one factor that has led to a decline in the rate at which hospitals make use of licensed practical nurses, since it encourages supplanting licensed practical nurses with registered nurses—usually those with hospital school diplomas—in the delivery of direct patient care. Another factor that supports this move is competition among private hospitals, which regard the use of registered rather than licensed practical nurses as a factor that helps attract patients to the facility. Finally, hospitals have found that they can cut the costs of providing this more expensive care by assigning its less skilled aspects to nursing attendants rather than to licensed practical nurses.

Thus, in hospitals, the future status of the licensed practical nurse is uncertain. However, in chronic care facilities, including nursing homes, the majority of the nursing staff often consists of LPN's, the more experienced of whom are likely to do some supervisory work as well. In these kinds of facilities, which also include many public psychiatric hospitals, the use of licensed practical nurses seems likely to continue and even to increase over time.

Again, we need to emphasize that these conclusions are tentative at best. There is little agreement among employers of health care workers about the future configurations of their nursing staffs. Much depends upon the financial status of the various kinds of facilities that employ such workers. This, in turn, depends upon factors that include the type and degree of public financing for medical care and the outcome of the currently competitive situation among private facilities. The degree to which registered nursing as a profession will succeed in the effort to differentiate the formal roles of Bachelor's degree, Associate degree, and diploma nurses will also play a part in determining the configuration of health service occupations in the future.

For people who work in health care, then, technological change is not a significant factor in changing skills, either because it is built into the job—at the higher levels—or because the job has not really been affected by technological change—at the lower levels. The important changes in this area will come from the reconfiguration of the health team, and at this point in time, what the health team of the future will look like is unclear. In the areas of pharmacy and degree nursing, and perhaps in medical technology as well, health care workers are moving toward assuming more responsible roles on the total team. In some areas, including all of those related to direct patient care, the locus of the job may shift. With the move toward early release of patients from the hospital and home care of the chronically ill, employers expect more positions with agencies that deliver such care to open up.

However, regardless of what other changes occur, all health care workers must have two sets of skills, one technical and the other in human relations. Human relations skills have always been important for people who are directly involved in patient care, but employers say that they are becoming even more important now and expect their importance to continue increasing in the future. Competition for patients and recognition of their rights as well as increased understanding of the relationship between emotional and physical well-being have increased the importance of human relations skills in the field of health care. Finally, the move toward the organization of patient care as a team effort means that pharmacists, nurses, and others must have the skills that enable them to work cooperatively along with physicians in order to provide the best care possible.

Teaching Occupations

Occupation	Employment 1980	Employment Projected 1990	1980-90 Change Numeric	1980-90 Change Percent	Average Annual Openings
Kindergarten, Elementary, and Secondary School Teachers	77,414	94,424	17,010	22.0	4,732
Teachers' Aides	11,557	14,514	2,957	26.0	596
Vocational and Adult Education Teachers	9,167	10,929	1,762	19.2	467
Child Care Workers	2,708	3,931	1,223	45.0	303
Total	100,846	123,798	22,952	23.0	5,678

The majority of people who teach work in schools that enroll children from kindergarten through twelfth grade, but teaching also includes other important occupations. Child care workers often do at least some teaching during the course of their working day. Vocational education teachers work with many different kinds of people, including high school students, the disadvantaged, and the handicapped. Together with adult education teachers, they may also provide instruction to people seeking retraining or new skills for personal or job enhancement.

These people are not the only ones involved in teaching activities, but they constitute the majority of those who have been trained as teachers. Many people who work in industry, including those involved in apprenticeship programs, spend a good deal of time teaching, sometimes in a classroom setting. College and university professors also spend a large part of their work time teaching, but these people are not primarily identified as teachers, either by others or by themselves. In most cases, they have not been trained in teaching skills or, at most, the training has been brief.

Teachers also work in many settings. Most kindergarten, elementary, middle, and secondary school teachers and teacher aides work in Virginia's public schools, the largest of which enrolled over 123,000 in the fall of 1984, while others work in secular or religious nonpublic schools, some of which enroll fewer than ten students. Child care workers, on the other hand, usually work in nonpublic settings, some for nonprofit, some for profit-making establishments. Vocational education teachers may work in organizations that train the handicapped, and adult education teachers may work part-time in private trade and technical schools.

Virginia has 135 separate public school systems, and public school teachers are found throughout the state. Although most of these school systems also offer adult education classes, adult education teachers are largely concentrated in the Northern Virginia area. In 1980, nearly half of all adult education teachers working in Virginia were employed in Northern Virginia. Nonpublic schools—and those who teach in them—tend to be heavily concentrated in a few areas, notably Northern Virginia, Richmond, Tidewater, and the Peninsula, though nearly every locality has at least one or two small nonpublic schools.

In 1980, teaching, as we have defined it here, employed well over 100,000 Virginians, and by 1990, this number is expected to grow by almost 23,000, with an average of over 5,600 openings per year. Among the four occupations included, public school teachers are expected to grow the most, increasing by about 17,000, while child care workers are expected to grow the fastest, increasing by 45 percent over the ten-year period.

Kindergarten, Elementary, and Secondary School Teachers

A teacher provides instruction, sometimes in one subject, sometimes in several, but this is only part of the job. In both public and nonpublic schools, teachers also perform a variety of other tasks, not all of them carried out during normal school hours. In addition to supervising students in the halls, lunchrooms, and other parts of the school, they prepare daily work plans, grade homework and tests, see students for remedial work, serve as sponsors of extracurricular activities, confer with parents, attend meetings, keep records, and do other kinds of paperwork as required by the school administration.

Teaching in a public school requires state certification, though in some systems a recent graduate may be hired without it and given a year in which to obtain it. In the public schools, the minimum educational requirement is a college degree, and in some systems a majority of the teachers either have higher degrees or are working on them. Requirements for teaching in nonpublic schools are more flexible. Some do not require certification, but do require a minimum of a Bachelor's degree, though not necessarily with a major in education. In some nonpublic schools—as in some public ones—many teachers have postgraduate training. Others, however, do not require a college degree and in fact have no set requirements in the area of education.

For teachers who graduate from four-year college or university programs in education—the case for most who teach in the public schools—on-the-job training is part of the college curriculum and consists of serving as a student teacher under the supervision of someone more experienced. Whether a school administrator prefers more experience than this often depends on the balance of experience in the system. In turn, just how this balance is weighted sometimes depends on how much experience the system can afford, since entrants into the field are normally paid less than those who have taught for some years.

The list of skills and personal characteristics that most employers want in teachers is, to say the least, a long one. Teachers are expected not only to know their subjects, but also to be able to apply the instructional techniques they learned in college and/or graduate school, to maintain discipline in a classroom, and to communicate both orally and in writing. They must manage relationships with their colleagues and supervisors, but they also need a special set of skills in managing relationships with children and/or young adults. Administrators want teachers to be genuine in their liking for young people, care about their students and communicate this attitude, and at the same time be sufficiently assertive so that discipline is not jeopardized, while maintaining enthusiasm for their subject matter, motivating student interest, and carrying out these tasks with energy and a sense of humor.

Until recently, school enrollment in Virginia was decreasing, and as a result, the supply of kindergarten and elementary teachers was plentiful. However, administrators mentioned some problems in finding high school teachers with particular specializations. The current shortage of teachers in mathematics and science has been widely publicized. Efforts to provide educational services to special students within public school systems—rather than paying their tuition in private schools—have led to shortages of special education teachers. An administrator in a nonpublic school also said that while it was easy to determine whether a candidate had the required expertise in a teaching field, it was not so easy to determine whether the candidate met other kinds of requirements, in particular the need for teachers who are truly concerned about students. Finally, rising kindergarten and elementary school enrollments—resulting from an increase in births that began around 1976—and declining education school enrollments—resulting from low pay and prestige—are already leading to teacher shortages in many parts of the nation.

Administrators unanimously perceive teaching as a field that has been heavily affected by computer technology, but the actual degree to which this has occurred varies among school systems and among teachers within those systems. In some schools, particularly those located in more affluent areas, many students are already computer literate and parents exert pressure for further education in the field. In others, equipment shortages and lack of expertise limit the degree to which computers can be integrated into the curriculum. However, in order to be accredited, all schools in Virginia, regardless of location, must provide some instruction to familiarize students with computers.

The way in which school systems are fulfilling this mandate varies from providing a minimum introduction to the new technology at the elementary level to requiring a course on computer literacy in junior high or high school. In addition, some schools offer electives in computer programming or business computer applications. The degree and manner in which microcomputers are used as teaching aids in other subjects varies even more widely, depending on the subject, the teacher, and the availability and type of both hardware and software.

Microcomputers have caused problems in some school systems. Administrators are quite specific about resistance on the part of some teachers to learning computer skills and using microcomputers, although it is not always clear just what the source of the resistance is. Part of it appears to be time. Teachers already have a variety of responsibilities that extend beyond basic instruction, and some apparently feel that they lack the time to acquire the skills necessary to use computer technology effectively. A related part of the difficulty is a lack of resources. Many teachers do not have easy access to lists and evaluations of suitable software. Others view the computer as a fad and do not recognize the degree to which computer use has permeated the work place. Finally, many teachers find that even if they are prepared to integrate microcomputers into their teaching plans, access to the small number of available machines limits the degree to which they can require their students to use them.

Nonetheless, some teachers are making greater use of microcomputers. Sometimes encouragement to do so comes from the example set by the clerical staff, who use the machines for administrative record-keeping and word processing. Sometimes it comes from in-school training and sometimes from the example of students themselves. But the problem is certainly not yet solved. Consequently, administrators are looking for teachers who can take advantage of the new technology, are adaptable, and will "change with the times."

Adaptability and flexibility will also be needed in the future, when even more will be required of teachers. Administrators suggest that standards will go up, that teachers may be expected to be better acquainted than they are now with disciplines outside their own, and that more courses and expertise will be required in the teacher's academic discipline and less in the area of teaching skills. This will be particularly true in technical and scientific areas.

Teachers' Aides

Technically, a teacher's aide works under the guidance of a teacher, carrying out such non-instructional tasks as preparing work materials, supervising students during play periods, and operating special equipment. However, in some schools where we interviewed, the duties of teacher's aides and educational assistants were far more professional than this definition suggests. In many cases, they do instruction, concentrating on one-to-one tutoring and remedial work. In addition, under a program called parallel scheduling, aides sometimes actually work with part of a teacher's class in a different physical location, bringing their job close to that of the lead teacher.

Educational requirements for teachers' aides, teachers' assistants, and educational assistants vary from none to a Bachelor's degree. Only one employer required experience. Other skills required were identical with those required for teachers, with the addition that the aide understand the relationship between the assistant and lead positions.

People who hire aides stress that the pay is extremely low in relation to the content of the job. However, because of two special circumstances, they have no difficulty finding job candidates. First, until recently, there was a shortage of jobs in teaching and related fields, and some teachers who could not find jobs took positions as teachers' aides. Second, there is a shortage of part-time jobs and a pool of women who want to work part-time and are willing to take low pay in order to do so.

Whether the job of being a teacher's aide is influenced by technological or, indeed, any other kind of change depends largely on the school in which the aide is working. If the school itself has become heavily involved with microcomputers, the aide will be expected to have or acquire the skills to function in this area. If not, the emphasis is likely to be on interpersonal skills—the ability to work well with children on a one-to-one basis. In either case, little change is foreseen in the future. As in other kinds of school-related occupations, the general sense is that the impact of technological change began a few years ago and will continue.

Vocational and Adult Education Teachers

According to the United States Department of Labor's definitions, vocational and adult education teachers differ in both the subjects and students they teach. Vocational education teachers teach skills specific to a particular occupation to students in high schools, postsecondary institutions, private trade and technical schools, and industry, while adult education teachers teach subjects that are not vocationally related to students who are not enrolled in formal educational or training programs. In reality, however, the two occupations overlap. For example, many of the students in vocational courses offered at community colleges—particularly those offered at night—take them for personal enrichment, while many who take adult education courses such as languages enroll because they want to enhance their occupational skills.

Vocational and adult education teachers consequently work in varied settings: secondary schools, private and public postsecondary institutions, industries that run their own training programs, and agencies that train special groups, such as the handicapped or disadvantaged. Additionally, many adult education teachers and some vocational education teachers are part-time nonprofessional teachers whose primary occupation is in the subject area they teach rather than in teaching itself.

Vocational and adult education teachers provide instruction in fields ranging from janitorial work to computer science to wine tasting, and their background requirements vary accordingly. Teachers who instruct adults in basic literacy and other skills must have a teaching certificate; otherwise experience in the field is more important than educational level.

However, employers want vocational and education teachers to have the same skills and personal characteristics as other teachers: interest in working with students, enthusiasm, the ability to communicate, and a positive attitude. In organizations working with special students, teachers also need to understand their special needs and may be required to have the administrative skills to design and implement in-house training programs and obtain jobs for graduates.

Employers have some difficulty in locating good candidates for these positions. Sometimes people who are technically qualified are not good at teaching; sometimes it is difficult to find prospective teachers who are trained in the latest technology; and often the pay for teachers is lower than that for practitioners in the field.

While the job skills involved in teaching are not changing very much, in many areas such as automobile repair, electronics, computer science, and clerical work, the skills being taught are changing a great deal. As a result, employers emphasize how adaptable and open-minded teachers need to be, and some believe that full-time vocational and adult education teachers should begin participating in the same training and retraining programs offered to employees. Some employers also believe that background qualifications for vocational and adult education teachers will be upgraded. They may require adult education teachers to have more hands-on experience in their subject areas and—if relevant—more experience with special students, while they may require vocational education teachers to have more formal education. For example, an agency that trains the handicapped is considering requiring a Bachelor's degree, and while one employer of people who teach electronic technology may require a degree in mathematics or engineering, another employer we talked to is working toward requiring a Master's degree to teach in this area.

Child Care Workers

Child care workers care for infants and pre-school children. They may be self-employed or may work for a nonprofit or profit-making establishment. Smaller child care facilities sometimes provide only basic care and supervised play. Larger facilities often have instructional programs as well. One center in which we interviewed was not only equipped with microcomputers but had some four-year-olds who had learned to program them.

The educational backgrounds and requirements of child care workers vary similarly. State licensing of the facility is required if it cares for more than six children, and the State has minimum standards for two categories of personnel. These are under review, but at present a program director in a licensed facility must have the equivalent of a high school diploma and 15 semester hours of college. A child care supervisor must be at least 18 years old, have a high school diploma, be literate, and have had some orientation or training, though the extent of such training is not specified. A third level, child care aides, carries no educational requirements, but aides must be at least 14 years of age and able to read and write. If they are under 16, they may not be left solely in charge of children. People at all levels must have records free from felony and child abuse convictions.

For the purposes of this study, we included all three levels of personnel under the title of child care worker. The facilities at which we interviewed were large enough to be certified, and consequently, the information we gathered is not necessarily applicable to situations in which a person cares for fewer than six children in a private home setting.

The educational backgrounds of child care workers in these facilities varied from high school through four or more years of college. Employers stressed that the job pays very little and that it takes a particular kind of person to do a good job for such low pay. This kind of person enjoys working with children, is good at communicating with parents, and is gentle, dependable, and flexible.

Geographic location affects how stringent these requirements can be and how easy it is to find good workers. In large metropolitan areas and in places near large colleges or universities, child care work is an option for well-educated women returning to the labor force, student wives, young mothers, and teachers who want to leave the field. In smaller places the labor pool tends to be less educated, though this does not necessarily mean that the care is not as good.

The future of child care work seems to include a greater degree of professionalization. Increasingly, parents who use child care services are demanding that workers be formally qualified. Partly these demands result from recent disclosures of abuse in child care centers and the belief that training programs would help to weed undesirable people out of this line of work. Partly they result from parents' perceptions that more highly qualified child care workers can provide children with training in basic skills and that such training can be an advantage when children enter school.

Not all employers are in favor of this trend. Some welcome it, support more stringent state standards, and would like to see training programs at community colleges, particularly if they involve internships. Others believe that increased requirements would lead to higher pay, thus driving the cost of child care out of the range of many of those who need it the most.

Teaching Summary

Teaching is changing in a number of ways related to new technology, particularly to the computer. With the growth of high technology industry and the ensuing competition of the United States for an assured place in the world market, pressures to teach skills that will both prepare people for new occupations and contribute to the development of a skilled labor force are mounting. Closely allied to these developments are two fears that are common during any era of rapid change: first, that workers will be replaced by machines; and second, that because of the pace of change, workers will not be able to keep up. These beliefs give rise to the hypothesis that in the future, nearly everyone in the labor force will need periodic retraining throughout adulthood. Thus the need for vocational and adult education will expand far beyond its present limits.

As a result of the new technology, teachers at all levels are under considerable pressure to change. At the elementary and high school levels, these pressures take the form of a state requirement that computer literacy be a part of the curriculum of all school systems, with computer literacy defined as *"the ability to understand the capabilities, applications, and implications of computer technology and to use this knowledge to function in society."* (1) In addition, teachers are encouraged to use the computer as a tool both in teaching and record-keeping, sometimes in ways that they themselves consider inappropriate or unnecessary.

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(1) Guidelines for Educational Computing in Virginia, Division of Instructional Media and Technology, Virginia Department of Education, 1984, p. 14.

Some elementary and high school teachers respond to these requirements readily; some do not. In the face of considerable workloads, some teachers resist what appears to be a requirement that they learn a new skill on their own time. On the other hand, employers say, some teachers welcome the computer as a helpful tool that promotes student interest and eases the clerical chores associated with the job. Whether the integration of the new technology into the curriculum and the classroom is easy or difficult apparently depends on a number of factors, including the bent of individual teachers, the quality of available software, the attitude of administrators, and the availability of adequate instruction and support for both teachers and students.

In the area of vocational and adult education, new technology also causes problems, but of a different kind. In these areas, the term "new technology" refers not only to the computer but to new machines, devices, and equipment of all sorts. The problems here lie with school equipment and the supply of teachers who are qualified and willing to instruct in these areas. In vocational and adult education, the necessity to train people on the equipment currently being used in the working world can be a serious financial problem. In addition, salaries for those who are qualified to teach in these areas must compete with those offered by private industry.

These changes are taking place in a context that includes increased pressures from administrators, regulators, parents, and the community at large. On the one hand, public schools and those who teach in them are perceived to be of low quality and vitally in need of improvement. On the other hand, teachers are pressing for more recognition, in terms of both financial reward and the less tangible ones of prestige and respect.

Perhaps the situation in regard to teaching and the new technology is best described in terms of society's needs and education's response. If it is the job of the latter to prepare people—whether through primary, general secondary, vocational, or adult education—to live in society, the job will change as society changes. If, as many seem to think, what we now perceive as rapid change is slow compared to what is still to come, then the outlook for teachers is one of ever more constant and rapid adaptation. How this is to be achieved will then be a central problem for educational administrators and planners as well as for teachers themselves.

Specialized Clerical Occupations

	Employment		1980-90 Change		
Occupation	1980	Projected 1990	Numeric	Percent	Average Annual Openings
Bookkeepers	40,679	49,372	8,693	21.0	2,504
Bank Tellers	11,216	13,209	1,993	18.0	553
Payroll/Timekeeping Clerks	5,188	6,258	1,070	21.0	304
Shipping and Receiving Clerks	7,229	8,457	1,228	17.0	300
Order Clerks	4,411	5,266	855	19.0	299
Personnel Clerks	4,161	4,849	688	17.0	220
Production Clerks	4,591	5,416	825	18.0	192
Total	77,475	92,827	15,352	20.0	4,072

The people in this group are specialized clerical workers. Usually they keep particular kinds of records—personnel records, financial records, inventories, and the like. Some work in special departments, such as payroll. Some do not work in offices at all; bank tellers, for example, are included here, as are production clerks, some of whom work on shop floors. Many of the jobs in this group are one step up from entry level and require special skills. Most have been affected to a considerable degree by the advent of the computer as a record-keeping tool.

As is the case with many other occupations, Northern Virginia has an unusually high proportion of jobs in this category, particularly personnel clerks and bank tellers. In fact, half of Virginia's personnel clerks worked in Northern Virginia in 1980 as did over a fourth of all bank tellers. A large concentration of bank tellers is also found in the Richmond metropolitan area.

Between 1980 and 1990, jobs for specialized clerks are expected to increase at a moderate rate, somewhat below the rate of increase for all wage and salary employment. However, the numerical increase in these jobs will be considerable, with bookkeepers alone adding almost 8,700 positions and offering over 2,500 openings each year.

Bookkeepers

A bookkeeper works with financial figures to implement an accounting scheme for a firm or organization, posting figures, preparing bills, calculating budgets and balances, and maintaining other kinds of detailed financial records. These operations may be done by hand, computer, special billing machine, or a combination of all three.

In a small office, the bookkeeper usually sets up and maintains the financial record-keeping system and may have other duties as well. Among those mentioned were managing the payroll, filling out federal forms, and handling personnel records. In short, the smaller the office, the more varied and skilled the bookkeeper's duties are likely to be, a tendency shared with most other office occupations. In some offices, in fact, the bookkeeper is the senior clerical person and functions as a clerical supervisor as well as a bookkeeper.

Even if it does not involve supervision, the bookkeeper's job requires a special set of skills. As a result, employers prefer some education beyond high school, though this need not include a degree. Courses in bookkeeping principles, business, and/or accounting are certainly considered useful, and at least a year of experience is an advantage to a job candidate even if it is not a requirement. Given this background, the characteristics employers look for most are honesty, accuracy, and attention to detail. Some employers have trouble finding good candidates for the job; some do not.

New electronic technology has affected all office occupations, and bookkeeping is no exception. The occupation is currently in a state of transition. Some bookkeeping is still done by hand; some is done on mainframe computers; and some is done on microcomputers. Sometimes an office uses a combination of all three methods.

Depending on the method or combination of methods in use, the bookkeeper may perform all the necessary calculations or none of them. If the system, or a part of it, is still being done by hand, the bookkeeper does the calculations. If a mainframe computer is the tool, the bookkeeper may enter the data into the computer or, in a larger establishment, enter it onto specially ruled sheets that are passed on to a data entry keyer. If the bookkeeping system is maintained on a microcomputer, the bookkeeper probably both enters the data and executes the programs that perform the calculations.

Employers agree, however, that the future of bookkeeping lies with the microcomputer and that they will be looking for job candidates who are familiar with these machines. For some employers, familiarity is all that will be required. For others, however, the requirement—or at least the preference—will extend to programming skills. In many cases, computer skills will, in fact, replace the requirement for bookkeeping principles. These will be built into the software, and only those who are expected to write bookkeeping programs will need to know bookkeeping principles.

Employers also agree that bookkeeping will take less time than it does now. In fact, one employer whose bookkeeping operation has been moved onto a microcomputer says that the job takes half the time it did before. This suggests that particularly in the small office the tendency of the bookkeeper to serve as office manager and/or general record keeper might increase as electronic technology frees more time.

Bank Tellers

All bank tellers process transactions between a customer and a financial institution, receiving payments, paying out withdrawals, documenting these transactions, and recording and filing the information. Recently, however, a major change has occurred in this occupation: many tellers are now required to be salespeople as well, encouraging customers to take advantage of the other services offered by the institutions in which the teller works. In fact, some institutions have adopted sales incentive plans, in which goals are set for tellers and bonuses awarded.

A high school diploma is required for tellers, though some employers prefer more, in the form of either accounting classes or Associate or Bachelor's degrees. In some institutions, about half the tellers are college graduates. In addition, most employers prefer job candidates with some work experience, especially in public contact and/or handling money. Institutions provide further training on the job, in either informal apprenticeship to an experienced teller or in-house training classes. The latter can be quite extensive, particularly in the area of sales and customer relations.

As one employer said about bank tellers, *"[We are] dealing with a relatively low-level job, but a very important job to the organization."* Employers emphasize that a bank teller must not only be dependable, good with figures, able to deal with a number of tasks simultaneously, and able to learn the routines of the organization, but also must be good with customers—outgoing, friendly, and self-confident. Some employers have trouble finding people with this combination of skills.

Financial institutions usually have a number of branches that serve local customers. It is the environment of the branch in which the teller works—rather than the parent organization—that directly affects the job, because the degree to which automation is present varies not only from company to company but from branch to branch. In some environments, computerization, in the form of terminals into a central mainframe computer, is almost total. In one such place, for example, bank tellers are now called customer service representatives and spend up to half their time working on a computer system; this is expected to increase to between 80 and 90 percent of their time. In other establishments, automatic teller machines are the only recent technical innovation, and while the machines may have reduced somewhat the number of customers who use teller services, the total effect has not been great.

In general, then, two changes have occurred in the bank teller's job: first, the increasing emphasis on the teller as first-line contact, customer service representative, and salesperson for the institution; and second, the introduction of electronic data processing. Sometimes only one of the changes has taken place; sometimes the other; and sometimes both. Whichever of them has occurred, however, employers tend to mention resistance. Comments range from *"I would say that 98 percent of the people in this building are intimidated by personal computers"* to *"Many older tellers who maintained that they could not sell have surprised themselves."* Moreover, employers expect change to continue. For instance, home banking by computer would reduce the basic functions of the teller. Ordinary transactions would require no contact between the teller and the customer, and recording of the transaction would be done automatically. Visits to the bank would then be mainly for purposes that are not routine, thereby enhancing the importance of the teller's skills in sales and customer service.

Due to recent changes in regulations, banks have lost their traditional monopoly on financial services and are increasingly involved in competition, not only with each other, but with other organizations as well. As a result, employers expect the number and kind of bank services to increase, with concomitant demand on tellers to learn about, recommend appropriately, and sell these services. Thus, while the job is not expected to disappear, it has already changed substantially in some institutions, and employers see this trend continuing. Partly as a result, many expect to upgrade their requirements for bank tellers, actively recruiting people who are both computer literate and interested in sales. *"But basically,"* one employer said, *"as expansion occurs, I think it will become an employee's market at least for the skilled ones."*

Payroll/Timekeeping Clerks

Payroll clerks record and calculate wage data and related information for an establishment. They may review time cards and leave slips, calculate fringe benefits, code salary changes, compute adjusted salaries, distribute checks, and carry out other tasks pertaining to the payroll. In specialized establishments some of their tasks may be similarly specialized. Where employees are paid by the piece, for example, payroll clerks may be responsible for collecting individual records of work accomplished and translating the numbers into their wage equivalents.

In general, employers of payroll clerks either require a high school diploma or have no specific educational requirement. Most of their payroll clerks come from a general high school background and learn the job through informal on-the-job training. Experience is generally not required, but the position is not always an entry-level one. In some establishments most payroll clerks have been promoted from lower-level clerical positions.

Since they deal constantly with numbers, good payroll clerks must have a grasp of figures and be able to manipulate them accurately. In addition, employers stressed the need for reliability and the ability to work under pressure. Payrolls, they said, need to be met accurately and on time, and it is important that the people responsible for this task meet these criteria. Nonetheless, no employer mentioned any difficulty in finding good people to fill the position.

Like bookkeepers, the jobs of payroll clerks involve changing technology. In some cases the operation has been computerized for some time, and employers do not foresee any more change. In others, computerization will take place in the near future, and the job will then change from one that is strictly clerical to one that requires the ability to operate computer software. If payroll clerks follow the pattern of other clerical workers, this change will probably cause problems for very few employees. The programs generally used for payroll purposes are designed to be used by people who are not familiar with computers and therefore require a minimum of training. Thus most people should be able to adapt quite easily.

Both employers who have already computerized and those who anticipate doing so agree that the new technology will produce a decrease in the number of payroll clerks needed in their establishments. However, they also agree that the job itself will continue to exist and that human checking and intervention will be required even when maximum automation is achieved.

Shipping and Receiving Clerks

Shipping and receiving clerks record goods leaving and entering an establishment. They may also prepare merchandise for shipment and may supervise other people who work in the shipping room, such as shipping packers. In many establishments, they also participate in physically moving the goods in and out.

Depending on the nature of the establishment, shipping clerk and receiving clerk may be two different jobs, with one or the other involving more responsibility. In one warehouse, for example, the shipping clerk had considerable responsibility in selecting trucks of the proper size for the merchandise and organizing the flow so that bottlenecks did not occur. In this

case, the receiving clerk simply saw to it that incoming merchandise was unloaded and stored in its assigned space. In a large retail establishment, however, shipping and receiving clerks spent most of their time at the receiving end. This involved more complicated tasks: checking to see that the merchandise was in good shape, checking numbers on the freight bill, and filling out company forms.

The job of shipping/receiving clerk is generally an entry-level position carrying no specific educational requirements. People enter from two kinds of backgrounds: either directly from high school, vocational education, or government-sponsored training programs; or via promotion from an unskilled job in the establishment. Most of the qualities employers listed as desirable related to good work attitudes: cooperativeness, flexibility, getting along with others, and reliability. Nor do employers expect shipping/receiving clerks to be heavily affected by technology. Although shipping and receiving records will increasingly be kept on a computer, the basic function of moving goods around will continue to be performed. Even the employer who thought that this work might eventually be done by robots did not expect this change to occur in the near future. For the time being, as one employer said, *"these guys are going to have to carry [the goods] up the steps, and until they do away with steps, that's about it."*

Personnel Clerks

In Virginia, 58 percent of all personnel clerks work for the federal government. They compile, process, and retrieve personnel records, and usually do some typing and filing. Often the personnel clerk acts as the liaison between management and employees, explaining policy and solving routine problems. Although the job description of personnel clerks in the *Occupational Employment Statistics Survey* dictionary says they record weekly earnings, absences, and the like, the employers we talked to mentioned these duties as those of a payroll clerk rather than a personnel clerk.

Employers generally want personnel clerks to be high school graduates, but they do not consider the job an entry-level position. They fill vacancies either by promoting lower-ranked clerical people or by hiring applicants with at least a year of experience. Training, however, is strictly on the job, and informal requirements are more important than the formal ones. Because they deal in sensitive areas and have access to confidential personal information, personnel clerks need both good interpersonal skills and integrity. They must also understand their employers' personnel policies and be able to explain and interpret them to others, and, as one employer said, they must be able to do this while maintaining their own objectivity, with *"empathy* *but not sympathy.*" Employers said they do not have much trouble finding people with these qualities, but they also stressed that not everyone is suitable for this job.

The record-keeping functions of personnel clerks have been changing as computer technology expands into this area. Across the board, employers emphasize that personnel records are either totally computerized already or will be in the near future. "*Everything we do,*" said one employer, "*goes into a computer base somewhere.*" Requirements for the part of the personnel clerk's job that deals with people will remain about the same, but employers are now asking for computer literacy as well. They expect to emphasize this requirement even more in the future.

Order Clerks

Order clerks take, record, monitor, and follow up on customer orders. In most firms sales are a separate function, but in some, order clerks are also salespeople. When they are, the job title is ordinarily, though not necessarily, different. In either case, however, the order clerk's position is an important bridge between the employer and the public.

All of the employers we spoke with required order clerks to have high school diplomas. Some, particularly those who combine order clerking with selling, or those who sell high technology equipment, or both, prefer a college degree. Others specifically do not want people who are "*college material,*" because they believe such people "*won't stay.*" Part of this variation comes with the kind of company; part comes from whether the company regards the position as the first step on a career ladder or as an end in itself.

Beyond this, employers look for people who are personable and reliable. Some prefer prior work experience of almost any kind, simply to indicate that the candidate is stable and has good work habits. Employers are also interested in people who "*are not afraid of the computer.*" The record-keeping involved in ordering is swiftly becoming computerized, and although employers are willing to train people on their own systems, they are concerned about computer resistance. This concern persists even though employers say they do not usually have trouble filling these positions and that most employees have not had serious problems learning to use computers.

Although the occupational projections for order clerks show an increase, some employers indicated that the use of computers has already decreased the number of order clerks they employ. Moreover, they expect this trend to continue. Some companies expect to centralize their operations, so that all orders are electronically transmitted to a central site and handled there.

If these developments actually take place, there could be a decrease rather than an increase in the number of order clerks needed.

Production Clerks

Most definitions describe the production clerk as someone who keeps records of what each subdivision of a total operation does, the supplies it needs, its schedule, and so forth. Using these records, the clerk then schedules, coordinates, and expedites the flow of inputs and outputs in order to ensure that the final product will be produced on time.

In reality, however, the title of production clerk is applied to a variety of jobs. These differ from firm to firm and sometimes from department to department within a single organization. In one establishment, for example, the production clerk's job involves maintaining electronic and manual filing systems, handling correspondence, and collecting and presenting data. In another, production clerks keep electronic records of withdrawals and deposits from the stockroom for daily reporting purposes, dispatch plans to the manufacturing floor, and do light typing and other clerical work. In this establishment, the person who carries out the coordinating tasks of a production clerk is called a shop floor controller or an expediter and is required to have three to five years of experience. In only one case we encountered did the production clerk's job consist mainly of scheduling, coordinating, and expediting. In this firm the production clerk helped establish work schedules for the various departments involved in manufacturing the product, coordinated the flow of parts so they reached the final assembly area at the proper time, and expedited the availability of materials to each of the operations.

Whatever the job content, people who employ production clerks agree about two things. First, the use of computers has affected the job considerably, and as a result, employers prefer to hire people who are already computer literate. Second, employers expect that the less skilled aspects of the job will disappear. If the job now consists mainly of office work, they expect it to be retitled upward. If it involves record-keeping or coordination, they expect the computer to take over these functions almost entirely. In this case they anticipate that the job will be eliminated in favor of a more skilled position that will be titled master scheduler or expediter. Educational requirements, they say, will rise concomitantly, as will the requirement for prior experience.

Clerk Summary

Among this group of specialized clerical workers, the basic skill involves record-keeping. Sometimes, as in the case of payroll clerks and bookkeepers, record-keeping means working with numbers. Other specialized clerks work with inventories, personnel records, and schedules. The degree to which these employees also work with people varies. In some banks, tellers are now expected to promote the use of an entire range of services offered by the institution. Order clerks function as company representatives not only when they double as salespeople but also when they take and follow up on customers' orders. Personnel clerks must be able to interpret their employers' policies to co-workers. In contrast, shipping and receiving, payroll, and production clerks generally have less need for human relations skills.

Because all of these occupations involve a great deal of record-keeping, they have been heavily affected by technological change. In most cases, the computer either is now or will soon be a major tool, and employers want job applicants who are computer literate. In addition, the use of the computer will probably reduce the number of employees required by each employer, simply because the kinds of tasks involved in these jobs—storing, retrieving, calculating, and coordinating—are precisely those that a computer can do better and faster than a human being. As a result, when computers are used as tools in these occupations, it takes fewer people to do the job. If the growth projected in these occupations is actually to take place, it will have to be because the number of employers grows at a rate that will offset the decrease in the number of employees per establishment.

Protective Service Occupations

	Employment		1980-90 Change		
Occupation	**1980**	**Projected 1990**	**Numeric**	**Percent**	**Average Annual Openings**
Guards and Doorkeepers	13,669	18,565	4,896	36.0	1,623
Corrections Officers	5,301	7,874	2,573	49.0	720
Police	15,058	17,501	2,443	16.0	490
Total	34,028	43,940	9,912	29.1	2,833

Of the three occupations included in this group, two—corrections officers and police—are society's traditional guardians against lawbreakers and are employed at all government levels. The third is guards and doorkeepers, an increasingly important supplement to publicly-provided services. Although the traditional image of a guard is of an armed, uniformed man patrolling the premises of an industrial plant by night, this kind of setting is only one of many in which guards and doorkeepers work.

Each of the four occupations included here are found to some extent in nearly every area of the state. Guards and doorkeepers are particularly concentrated, however, in the Northern Virginia area. This is most likely due to the concentration of high technology industries found in Northern Virginia, since these industries rely heavily on security and consequently employ large numbers of private security personnel.

In 1980, about 34,000 people were employed in these occupations, and by 1990, the number is expected to increase by almost 1,000. Adding openings created by separations to those created by growth, over 2,800 new jobs in the area will be added each year in the decade of the 1980's. By 1990, the number of privately-employed guards and doorkeepers is expected to exceed the number of publicly-employed police.

Guards and Doorkeepers

Guards and doorkeepers protect property. Typically they work for private service companies which contract their services to other companies or organizations, and their tasks vary from firm to firm. For example, in addition to standing at entrances or patrolling premises, they may also control traffic, check visitors in and out, and even oversee the unloading of trucks and check contents to see that the order has been filled.

Employers sometimes require guards and doorkeepers to have a high school diploma, and nearly all employers prefer one. The background of people working in the field includes high school vocational education programs, general high school, public adult vocational education programs, government-sponsored training programs, community colleges, and four-year colleges. Experience is not absolutely required, but employers usually give preference to experienced candidates. Military retirees also tend to be preferred. Guards who will not carry arms must take a minimum of 12 hours of training in a program accredited by the Department of Criminal Justice and pass an examination within 120 days of employment. Armed guards must take 16 hours of instruction and pass a weapons test before they can be hired.

Employers would like guards to be responsible, reliable, loyal, level-headed, and trustworthy. Guards should be able to act independently and make the correct decision in emergencies, and they also must be able to handle the public in a friendly and courteous manner. In the more visible of stations, companies are moving toward what one employer called "blue-blazer" guards, people who project a better public relations image for the company that contracts their services. Guards who function in this capacity must be able to convey this image.

Technological innovation, largely in the form of electronic surveillance techniques, has become a part of this occupation, but according to employers, it has not markedly changed the level of skill involved. Because the firms that contract for the services of guards and doorkeepers are often not willing to pay very much, employers have difficulty finding good job candidates. Employers expect robots to enter the field, particularly in patrolling large areas. This may reduce the number of guards a single company would need, but two factors will probably ensure that employment opportunities continue to grow. First, the high cost of new technology will likely place it out of the reach of small companies. Second, as municipal budgets are cut back and industries locate further from population centers, the ability of public agencies to provide sufficient police surveillance is reduced, and employers face an increasing need to provide their own security forces.

Corrections Officers

Although the list of duties of a corrections officer, or jailer, may vary with the size of the institution, the basic task involved is maintaining security within the jail or prison, and the basic skill involved is observational power. These generalizations cover a multitude of smaller tasks: checking inmates and the security features of the building, overseeing meals, itemizing and recording personal possessions of prisoners, checking visitors, controlling keys, and in field stations, working in the kitchen and taking prisoners out on field duty. Corrections officers are also involved in prison industry, including farming, but constant observation to locate potential sources of trouble in the institution remains the basis for these tasks.

A corrections officer is expected to have a high school diploma or its equivalent, though increasing numbers have also had some community college courses. All officers participate in three phases of training: 48 hours of training at a correctional institution, 40 hours of on-the-job training at the institution, and three weeks at the Correction Department Training Academy in Waynesboro. At the end of this training they are evaluated and tested. Some are also required to take training in first aid and cardiopulmonary resuscitation. They should be responsible, honest, stable and levelheaded—particularly in emergencies—and should have good human relations skills as well. Correctional systems are coming to prefer candidates with more than a high school education, sometimes up to and including a Bachelor's degree, particularly in such fields as sociology or criminal justice. Sometimes, however, candidates from these backgrounds are difficult to find, since both the pay and prestige of the corrections officers' job are low.

Technological change, while occurring in the form of computerized recordkeeping and new surveillance equipment, has not really changed the basic tasks of the corrections officer. The major change that has taken place occurred during the 1960's and early 1970's, when the concept of an officer as a prison guard gave way to one who had to be more conscious of the human relations aspects of dealing with inmates. This concept requires that, in addition to being skilled at observing, the corrections officer needs to understand inmates' rights, recognize symptoms of mental illness, and communicate both with inmates and about them to officials and others concerned with their status and welfare.

The occupation of a corrections officer is one in which technological change is probably at an early stage. As such change continues, employers say, *"surveillance-by-technology"* will result in less emphasis on the security-keeping aspects of the job and more on the human relations aspect. Along with these changes, they expect training requirements in the use of new equipment to increase and educational requirements to grow along with the new professionalism of the job.

Police Officers

Police officers carry out a variety of tasks related to law enforcement. To mention just a few of the more traditional duties of police, they do routine patrols, carry out initial crime investigation, respond to accident calls, direct traffic, enforce laws pertaining to the sale and use of drugs and alcohol, and often play a role in mediating family disputes. In rural areas that do not have their own police forces, the state police perform these functions. In urban areas, these functions are the province of the local police, and the state police are responsible mainly for traffic-related duties on state or federally-maintained roads. Further, in large police forces, duties often differ by shift. In these cases, though the basic enforcement responsibilities remain the same, the problems confronted by police working day, second, and late shifts tend to differ. Finally, all police officers are responsible for keeping records, testifying in court, referring complaints to appropriate local agencies, and being involved in efforts intended to educate the public about such subjects as crime prevention, rape, and drug abuse.

High school graduation is the minimum educational background for police officers, but some jurisdictions express a strong preference for at least two years of postsecondary education. In addition, police candidates who meet initial physical requirements usually take a variety of tests that may be oral, verbal, or both. They may include tests for emotional stability, aptitude, intelligence, physical capacity, or all of these. Polygraph tests may be included. Finally, once accepted into the force, officers normally undergo training both at the Police Academy and in the field. The time they spend in each kind of training differs among systems, as does the length of their probationary period.

As might be expected, the range of personal characteristics required of a police force member is considerable and among the widest of any occupation we have encountered. Police officers must deal with people of all types, and their conduct is often crucially important in the outcome of potentially violent situations. Among a long list of desirable traits, employers mentioned honesty, integrity, courage, maturity, and patience. In the face of this, some systems appear to have problems finding good applicants, and some do not, although there seems to be no particular pattern that explains where difficulties might be located.

People differ in their opinions about whether police work has changed much in the recent past. Certainly, police are now using tools that were not available a few years ago. In some places police cars are equipped with computers; the use of nonlethal weapons has increased, and important changes have taken place in the lethal weapons used as well. Some police departments have incorporated more of these changes than others, and this seems to be the major cause of the discrepancy in opinions about change. In general, even where change has been considerable, it seems to have caused few problems, and the consensus is that regardless of technological change, the basic nature of the job remains the same as it has always been.

However, a number of nontechnical changes have taken place in police work. The most widespread of these has to do with the involvement of police in crime prevention and citizen education, including, for example, work with neighborhood watch groups and anti-drug lectures in the schools. Another change has been the increased emphasis on applied psychology and conflict management. Also mentioned were more cooperative work with other local agencies; emphasis on detail and rules resulting from court decisions that protect the rights of accused criminals; and increased specialization, with officers taking special training in narcotics, organized crime, wire tap techniques, and the like.

All of this means that both the selection criteria and the training requirements for police have changed and that this trend is expected to continue. Increased emphasis on public education and psychological techniques as well as weapons sophistication will probably upgrade the educational background required of police candidates and increase the length of training programs. Although the basic nature of law enforcement will remain the same, police work will change to accommodate to social as well as technological change. As one person pointed out, enforcement is heavily influenced by the current trends in both the community and the society at large. Consequently, as social attitudes change, these will be corresponding shifts in emphasis in police work. In the end, police remain responsible for enforcing society's rules, but they must also alter their approaches and techniques to respond to shifts in those rules.

Protection Summary

The protection occupations included in this study are police, corrections officers, and guards and doorkeepers. To some degree, all of these occupations have been affected by changing technology, but employers emphasize that technology has not caused any basic change in the jobs these people do. Further, since all of these jobs involve formal on-the-job training, some of it quite extensive, pre-employment acquaintance with job technology is not usually required.

In all of these occupations, however, human relations skills are becoming more important, and for both police and corrections officers required educational levels are rising, with employers preferring candidates to have postsecondary training. Increased reporting requirements, involvement of police in public education, employment of guards and doorkeepers in publicly visible locations, and new concerns with the relationship between the emotional well-being of inmates and prison security all increase requirements for skills in human relations. This is a trend that is now in process and may be expected to continue for the foreseeable future.

Computer-Related Occupations

	Employment		1980-90 Change		
Occupation	1980	Projected 1990	Numeric	Percent	Average Annual Openings
Systems Analysts	11,518	19,345	7,827	68.0	968
Programmers	8,524	12,776	4,252	50.0	558
Computer Operators	5,570	9,163	3,593	65.0	450
Data Processing Machine Mechanics	1,217	3,371	2,154	177.0	225
Data Entry Keyers (1)	NA	NA	NA	NA	NA
Total (1)	26,829	44,655	17,826	66.0	2201

(1) Figures for data entry keyers are not available. Totals for this cluster are consequently conservative.

In 1985, a significant number of people use computers at work, but this group consists mainly of those who install and repair the hardware, write the programs, and design the systems that the rest of us—computer users—use.

Most of these people are specialists, though not all the work they do requires extensive training. In fact, because the fields are new, many of the people now employed in these occupations do not have the formal training employers expect to require in the future. The exception is data entry keyers, who use computers only in order to enter information. They are unskilled people whose jobs are more similar to those of certain clerical workers than to those of most other computer specialists. However, in most classification schemes, data entry is included in the list of computer-related occupations, and we have chosen to follow that practice here.

Because computer technology is changing rapidly, the jobs of computer specialists are also subject to rapid change. New hardware (equipment) and software (programs) appear on the market constantly, and keeping up with these changes is a requirement for everyone who works in the field. A career in computers is consequently a career in constant re-education and retraining.

Since computers have pervaded the work place, computer specialists are employed in nearly every industry, but like most occupations included in this study, computer-related employment is found primarily in metropolitan areas, particularly in Northern Virginia, which accounted for slightly over half of the total computer-related employment in the state in 1980.

Of all the occupational groupings in this study, computer-related employment is expected to have the fastest rate of growth. Without counting data entry keyers, for whom projections are not available, jobs in this area are projected to increase by 66 percent between 1980 and 1990, adding nearly 18,000 positions. During this period, demand for people able to repair and maintain computer-related equipment will produce a 177 percent increase in data processing machine mechanics; and even programmers, who have the lowest growth rate of any of the occupations in this group, are expected to grow by 50 percent. Employers also expect jobs for data entry keyers to increase.

Systems Analysts

As a job title, the term "systems analyst" can have a number of meanings. The only basic skills that systems analysts have in common are advanced programming and a thorough knowledge of computers. Beyond this, the job varies from field to field and firm to firm. A systems analyst may be a staff member who is a senior programmer, or the member of a team who acts as liaison between staff and management, or a manager who is expert in the computer area.

For example, a systems analyst is often the person who meets with a client to formulate the problem and determine the programming needs and requirements, including the time-frame of the project. In a small firm or organization, the analyst may also do some or all of the programming, install the software on the client's computer system, and supply support services as well, answering clients' questions and correcting problems that arise after installation. In a larger firm some or all of these tasks are passed to programmers, who are supervised by the analyst acting as the head of a team. The analyst may then install the system and serve as liaison between programmers and the client. The client, in turn, may be a customer or, in large firms, another department of the same company.

Consequently, in addition to the basic skills, systems analysts may need any or all of the following: considerable familiarity with the field in which the work is to be done, managerial skills, leadership ability, and the ability to communicate about highly technical matters with users and managers who are not necessarily technically sophisticated. Depending on the environment in which the analyst works, familiarity with software packages used in the area may also be required. In other words, the systems analyst is the highest-level computer expert, expected to be familiar with all aspects of computer technology as it is used in the organization and to have a broad range of skills.

The job of a systems analyst is not an entry-level position. Employers often require six or seven years of experience as a programmer, though in some cases education may be substituted for part of this. Currently, some systems analysts have only a high school education, though employers make it clear that in the future more will be required. In addition, systems analysts undergo a considerable amount of on-the-job training in the specific systems and kinds of application employed. Analysts may also be strongly encouraged or required to take courses throughout their period of employment in order to keep up not only with the rapidly changing technology of the computer environment, but also with learning management techniques.

Employers want systems analysts to have all the qualities of a good programmer: intelligence, logic, reasoning ability, and a strong work ethic. In addition, employers stress the ability to communicate, both orally and in written form, and the interpersonal skills needed to deal with the client who contracted for the services, the people who are actually using the programs, and management. They also generally agree that good systems analysts with the expertise needed by specialized firms are difficult to find. For example, employers in organizations where the computer applications are primarily scientific often find that most systems analysts are experienced in writing programs that are oriented more toward business than scientific uses. On the other hand, in the business area, the analyst may be expected to know accounting principles or have managerial skills that most people in the computer field lack.

The systems analyst's job has been changing in both technological and nontechnological ways. The two major technological changes, employers said, have been the switch from mainframe computers to mini and microcomputers, and the advent of software packages that can be integrated into the systems that the analyst designs. As a result of the first of these changes, systems analysts have had to learn how to design programs and systems that use entirely new techniques and strategies. As the result of the second, there is less of the basic work to do. The proliferation of software packages and the spread of programming skills, particularly in the scientific community, have decreased the amount of basic work to be done by professional programmers and systems analysts, leaving the analyst to deal with only the more complex problems of system design and implementation. Meanwhile, the new emphasis on client contact, team leadership, and management requires interpersonal and administrative skills that were formerly not needed for this job.

Given the variety of jobs subsumed under the title of systems analyst, it is not surprising that employers see the future of the occupation differently. In areas such as financial management, where software packages that do the more basic jobs are already readily available, some employers predict falling demand for systems analysts. In these areas, they may well become software consultants. Rather than designing and/or producing custom-written software systems, they will need to be widely acquainted with microcomputers in order to recommend the best equipment and software for the client's application.

Where systems analysts work in-house, and in scientific fields, employers see their future as one of increasing specialization that will take different forms in different organizations. In some organizations, employers predict specialization by type of application. For example, an analyst may specialize in data base management rather than number manipulation. In other organizations, employers predict specialization by field. In this case, a systems analyst will specialize not in implementing particular kinds of software systems—financial or scientific, for example—but will instead specialize in an area of knowledge, such as geology or biology, and probably in subfields of these.

Computer Programmers

The fundamental task of a computer programmer is to translate verbal instructions that describe what the computer is to do into a code that enables the computer to carry out these instructions. The broader range of tasks that a programmer may perform includes maintaining existing programs—trouble-shooting, for example, when the programs do not function properly; writing documentation so that the user can run the program correctly; and developing systems of interlinked programs. In the latter case, the job overlaps with that of systems analyst.

In the 1980's, computers are found in business and industry, in the public as well as the private sector, and consequently, so are programmers. They may work in software companies that produce programs for outside clients or in computer departments that produce programs for in-house use. Their jobs also vary with the type of application they produce and the kind of computer for which the program is written. While the basics of the computer language remain the same, programs written for scientific calculation differ in important ways from those written for accounting. Similarly, the way in which a program is written varies according to whether it will be run on a large or small computer, and the language in which it is written often varies according to both the kind of application and the machine that will be used. Thus, programmers are often required to know more than one programming language.

Accordingly, the educational background and previous experience employers look for in hiring programmers also varies. Some require a Bachelor's degree with a major in computer science, but many do not. Educational requirements, in fact, range from none at all through four years of college, though it seems unlikely that most employers would hire a programmer who had not graduated from high school.

Whether an employer requires programmers to have previous experience seems to depend largely on the size of the firm. Larger organizations in which programmers are working in a pool often have several grades of programmers and will hire inexperienced people in trainee positions. These organizations, agencies, or firms may also have on-the-job training programs, or they may send their trainees to outside agencies to learn new computer languages and other skills. Smaller employers without these formal training facilities often require at least two years of experience as a working programmer. Some employers also prefer acquaintance with the area in which the application is to be written. A bank, for example, might give an advantage to a job applicant whose experience has been in writing programs in the banking or accounting area over one whose experience has been mainly in writing programs that perform statistical analysis of scientific data.

In addition to the basic tools of the trade, employers want programmers who can communicate, have a strong work ethic, get along with people, and are intelligent. The main requirement of a programmer, however, is logic, expressed by employers as *"the ability to think through a program logically,"* *"the ability to make logical decisions and work in logical order,"* *"skill in analysis of what needs to be done,"* or just plain *"logic."*

Employers do not always find it easy to locate people who are capable of using logic, even among those trained as programmers. While not all employers have this problem, where it exists, it is perceived as a difficult one. To some degree lack of logical ability is perceived as an innate deficiency. However, employers also see this lack as partly the fault of training institutions that do not weed out the nonlogical student during the training process. They stress that schools and colleges often have out-of-date equipment and that *"exposure in the classroom does not model the real world."*

Programming—itself the product of fairly recent technological innovation—is heavily affected by changing technology. As hardware changes, software must also change. Since change in hardware is rapid and continuing, employers sometimes feel that they cannot keep up. *"Hardware technology moves forward at about ten times the pace of software technology."* In addition, as improved technology makes the programmer's fundamental tasks easier, the job of the programmer often expands. A programmer who formerly did nothing but write programs now may be required to have skills ranging from the ability to fix terminals to problem-solving and system-design.

Such rapid change causes problems for some employers, who find that their programmers have not kept up with recent developments or are unable to use written materials to learn new skills. Accordingly, educational requirements may be upgraded in the near future. Beginning programmers will be required to have at least an Associate degree from a community college, and many employers will require a degree from a four-year institution. Employers also mentioned two additional possibilities. First, programmers may be required to have some acquaintance with the area or field in which they work. Second, educational requirements could be expanded all the way to the postgraduate degree level, with programmers being required to specialize in particular areas of programming, such as data bases, communications, or scientific applications.

Although computer programmers will continue to be needed, employers see demand dropping by the turn of the century. They emphasize that the current state of software is "immature" and that more varied software packages will be available in the future. As a result, many firms and agencies will use pre-written software instead of custom programs that are written by their own programming staffs. If this comes to pass, the employment of computer programmers will be centralized in large software-producing firms that will emphasize speed and specialization.

Computer Operators

The job of the computer operator is another that varies widely, particularly where microcomputers have wholly or partially replaced mainframe computers. Originally the title referred to the person who oversaw the operation of mainframe, preparing and loading peripheral equipment, operating the console, monitoring the system, scheduling long jobs, doing daily backups, and trouble-shooting. Certainly many firms and organizations still use mainframes and/or minicomputers, and the traditional definition of the operator's job remains valid. However, where part or all of the computer operations have been converted to microcomputers, the operator's job has tended to retain its title but change its function. This is also the case in small firms, where operation of a single minicomputer—a computer intermediate in size between the mainframe and the microcomputers—may not occupy the operator full-time.

As a result, operators may, in addition to their central role, do data entry, prepare microfiche, use the computer to sort checks, and the like. Even in firms with full-fledged mainframe operations, entry-level operators may do some or all of these tasks while more experienced operators carry out the more demanding ones, such as trouble-shooting.

Regardless of level, it is doubtful that anyone without a high school diploma would be hired as a computer operator, and most employers prefer specialized training: work toward an Associate degree in computer science or data processing classes in high school. They also consider computer programming skills a plus for operators. Previous job experience is often preferred, but on-the-job training on the organization's machine(s) is always provided, usually on an informal basis by a more experienced operator.

Computer installations frequently function 24 hours a day, and employers therefore want computer operators to be willing to work night shifts. They also want people who can follow directions but have sufficient competence and initiative to work without close supervision. These jobs are highly skilled and involve a considerable degree of responsibility, particularly when problems occur in the off-hours. As a result, some employers prefer computer operators who are aiming at higher positions. These employers intend the job to be the bottom rung of a career ladder in computer-related occupations, and they prefer to hire people who want to advance rather than those who intend to remain in the occupation throughout their working lives.

Like others in the computer field, operators must adjust to constant technological change. The move from mainframe to smaller computers has had a particularly severe effect on this job. Although there is general agreement that mainframes will not disappear during the next 15 years, the shift to desktop microcomputers has produced a declining demand for the larger machines and consequently for the people who operate them. Microcomputers are operated by the people who use them, and as their use increases and that of larger computers declines, the number of traditional computer operator jobs is also bound to decline. It would seem that if the occupation is to expand as projected, its content will need to undergo considerable redefinition.

Data Processing Machine Mechanics

Since computer systems of all sorts have come to be familiar equipment in offices, people who repair data processing machines no longer work only on large mainframe computers but on all manner of machines, ranging from small microcomputers to systems that link many kinds of machines into a single network. As a part of this process, the job has come to involve not only repairs on single machines, but also assembling systems out of component parts, checking them out, packaging, and installing them.

Employers have no set educational requirements for data processing machine mechanics. The important skills, employers say, are mechanical aptitude, problem-solving ability, and a thorough background in electronics. People who repair computers and other electronic data processing machines must be creative in their approach to diagnosing and solving problems in a technology that is still new and in some cases experimental.

In an area this new, many of the people who hold these jobs entered the field before formal training programs were established. Thus they have obtained their skills in different ways, including high school and community college courses, private trade and technical schools, four-year colleges, government job-training programs, the military, and even mail-order courses in electronics.

However, the various kinds of electronic data processing equipment, as well as the various makes and models of each kind, differ considerably. Consequently, while there are many ways to learn the basic skills, learning to apply them in an establishment that services one or two brands means becoming familiar with the complexities of those particular machines. Even then, new models with which the repairer must quickly become familiar enter the market frequently. As a result, the specific skills learned on one machine are often not easily generalized to others, and employers offer extensive on-the-job training even when new employees are experienced.

Regardless of the kind of machine with which the mechanic deals, installation, maintenance, and repair frequently take place on-site. Even when machines are brought to the shop for repair, customers and repair people interact directly. As a result, the skills required to deal with customers are as important as those required in dealing with the machines—even more important in the assessment of some employers. Data processing machine repairers must be able to communicate about technical matters with customers who are not necessarily technically oriented and must know how to be tactful while explaining that the fault lies with the customer rather than with the machine.

Employers agree that people with this combination of skills are not, as one put it, "*overabundant.*" However, actual difficulties in finding good applicants vary. Some employers find it very difficult; some promote from within, and some simply consider themselves lucky to have found and kept good people. Meanwhile, the job itself is changing in two major ways. First, technological change continues to provide more help with the diagnosis of problems, and repairing machines is easier as it comes more and more to involve replacing a module rather than fixing it. Second, as the use of the machines becomes widespread, the emphasis placed on the customer relations aspects of the job increases still further. In fact, in many cases the repairer becomes the customer's most frequent and important point of contact with the company or establishment. A customer may see a salesman to begin with, but once the sale is made, that relationship is ended and transferred to the person who will repair and maintain the system. This person then becomes responsible for maintaining good long-term customer relations as well.

As an occupation, repairing data processing machines has been brought into being by technological change and is constantly affected by it. Although this change is expected to continue, opinions differ as to how it will affect repair people. Some employers feel that as machines become more reliable and self-diagnostic, the job will actually require less skill. Some see no real change except in the machines, and they stress that only a good background in electronics will enable the repairer to keep pace with these changes. In general, however, employers predict that the emphasis on customer relations will continue to grow, and that the interpersonal skills involved will increase in importance.

Data Entry Keyers

In the majority of establishments where computers are used for data storage and retrieval, microcomputers and computer terminals have replaced punch cards as the means of data input. As a result, data entry keyers, who use electronic equipment to enter information, have replaced keypunch operators, who operated the machines that punch cards, and "data entry keyer" has now become the official title of this occupation. However, the occupational survey on which our data are based was carried out before this change, and consequently employers tend to answer the questions about keypunch operators in terms of data entry keyers.

The two occupations are, in fact, very similar. Keypunch operators type data on a keyboard resembling that of a typewriter, and the keypunch machine automatically translates their input into punched holes on a card. Data entry keyers use computer terminals, and the output goes to a different medium—cassettes, floppy disks, hard disks, and the like—but they still use keyboards to enter the material, and the material itself remains virtually the same. In either case, operators enter data from a form and have little responsibility for the content of the information, which may consist of words, numbers, or both.

Employers have no particular educational qualifications for this occupation, but most indicate that their data entry keyers are high school graduates, from either general or vocational education programs. Some data entry keyers have also taken courses in private trade or technical schools. The only skill required is the ability to use a keyboard with a high degree of accuracy. The kind of keyboard is actually not important, although it may take a few days for a keyer to reach top speed on one with an unfamiliar layout. In any case, minimal on-the-job training on a machine is usually provided by the employer.

Given familiarity with the keyboard, a data entry keyer must be able to achieve sufficient speed to meet the quotas established by the employer and to tolerate sitting in front of a terminal screen for long periods of time. Often keyers must meet production schedules and quotas, working under the requirement that a certain number of input forms must be completed per hour, with a given degree of accuracy. Sometimes, too, long hours are required to meet deadlines, with compensatory time off, but this is by no means true in every job.

The major technological change involved in data entry is the one from keypunch machines to terminals, and it has already occurred. Employers predict no further major technological, educational, or training requirements for the job, nor do they indicate any difficulty in finding job applicants. However, some employers predict a decrease in demand as data entry is decentralized. For example, if a store clerk enters transactions directly into the computer at the time of sale, the need for a data entry keyer—who effectively serves as an intermediary between the salesperson and the computer—ceases. In general, however, most employers believe that the occupation of data entry keyer will continue to exist and that the only change will be in increasingly sophisticated machines that will require only minimal retraining for their use.

Computer Summary

Given the proliferation of computers in both the private and public sectors, it is not surprising that computer-related occupations are projected to be among the fastest-growing occupations in Virginia. Keypunch operators are the only declining occupation in this group. Since punch cards as a medium for computer input are all but obsolete, keypunch operators are no longer needed. However, employers expect the need for data entry keyers to grow, and retraining is simple enough that the change should not result in the loss of many jobs.

The occupations we have included in this group range from the relatively unskilled job of the data entry keyer to the highly skilled profession of the systems analyst. In between are people who repair, operate, and program computers, each of whom is required to have a separate set of skills. However, except for data entry keyers, all these occupations have two basic skills in common. In all of them, employers want people who can reason logically and creatively and who can solve problems independently.

All these occupations are also affected by rapid change. Its effects on people who maintain and repair computers are fairly obvious. Though employers offer considerable in-house training on new machines, older ones continue to be in use and in need of servicing. As a result, the diversity of the machines with which the technician must be familiar increases constantly and is likely to continue. Changes in computer technology have similarly affected operators. The job of the operator is both highly skilled and machine-specific. This means that operators who are trained on new equipment are frequently not able to transfer their skills to older equipment, and vice versa. In addition, the arrival of mini and microcomputers has either radically altered or eliminated the jobs of many computer operators.

For programmers and systems analysts—or programmer/analysts—the effects of rapid change are different but no less important. The invention of new languages, changes in all types of hardware, and increased availability of commercial software are all factors to which programmer/analysts must constantly adjust. For these people, the trend toward specialization is also becoming significant and, according to employers, is expected to become even more so in the future. Considerable specialization in business versus technical-scientific applications has already taken place. Now, employers increasingly want programmer/analysts to be familiar with the fields in which they work. Accounting firms, for example, want programmer/analysts who are familiar with accounting practices. Engineering firms want people who have some acquaintance with engineering principles. Educators want programmers to know something about how learning takes place among the children who will use their programs as well as about the school settings in which they will be used.

These requirements indicate that future programmers and systems analysts will almost certainly be required to undergo more formal education than they are presently required to have. At present, some of the people holding these jobs have no formal education beyond high school, and many have not graduated from college. If the trend toward specializing in particular fields continues—and we have every reason to believe that it will—programmer/analysts are likely to find themselves needing at least four years of college and perhaps more.

The question for training programmer/analysts will then be which of many possible configurations of training are most appropriate. Programmers could, for example, enroll in regular degree programs in a field such as engineering or education, taking university-level programming courses at the same time. Or they might graduate from college and then acquire programming skills at a community college or private trade school. Or programmers who have not graduated from college might supplement their education with postsecondary courses in the field(s) in which they wish to work.

Whatever the answer, the pace of change in this field is likely to continue. It is also likely, though unfortunate for those who need to plan for training in the area, that we cannot foresee all of the changes that may affect these occupations during the next few decades. Although there is little doubt that computers will continue to proliferate, and there is every possibility that computer-related occupations will continue to expand, the precise tasks that will be assigned to each occupation, and therefore the precise skills that will be needed, remain largely unknown. People in computer-related occupations will need to be equipped with the kind of training in logic and problem-solving that will enable them to adapt swiftly and easily to constant technological change.

Repair Occupations

	Employment		1980-90 Change		
Occupation	**1980**	**Projected 1990**	**Numeric**	**Percent**	**Average Annual Openings**
Automobile Mechanics	17,110	21,715	4,605	27.0	867
Maintenance Mechanics	9,750	11,137	1,387	14.0	374
Office Machine Servicers	1,676	2,855	1,179	70.0	157
Refrigeration and Air Conditioning Mechanics	3,550	4,223	673	19.0	156
Total	32,086	39,930	7,844	24.0	1,554

People in the four occupations included in this section repair cooling equipment, automobiles, plant machinery, and office machines. These are not all of the occupations we studied that include repair work. Computer repairers, for example, are grouped with others whose occupations are directly related to these machines. Electricians, who do considerable repair work, are also heavily involved in production and are consequently grouped with production workers.

In general, repair work is a skilled occupation, and it is becoming even more so. A repairer needs a thorough acquaintance with the equipment and an understanding of how it works to diagnose and remedy its problems. As technology changes, new kinds of understanding are called for. Constant change also requires increased time and training to develop the necessary familiarity with the new equipment. Technical specifications and manuals are becoming increasingly important tools, as are the basic reading skills needed to make the best use of them. Logic and the ability to reason and generalize can help enormously in adjusting to change.

In three of the four occupations included in this group—air conditioning and refrigeration mechanics, automobile mechanics, and office machine repairers—the work includes close customer contact. Not only employers but also those who manufacture the equipment are concerned with the quality of this contact. Often the repair people are the company representatives seen most often by the customer. Often also, the repair person works for the manufacturer—as in the case of some office equipment—or the customer does not distinguish clearly between the manufacturer and the owner of the repair shop. The interpersonal skills that enable a repairer to serve adequately in the areas of sales and public relations are new ones for many in these occupations. For some, they constitute as much or more of a difficulty than technological change.

Except for maintenance mechanics, who are concentrated in Northern Virginia, people who do repairs are found throughout the State. Between 1980 and 1990 the number of people employed in these occupations is expected to increase by 24 percent to just under 40,000. On an annual basis, over 1,500 openings in this kind of work are expected each year. Automobile mechanics alone are expected to increase by over 4,600, but the fastest-growing occupation will be office machine servicer, with a projected growth rate of 70 percent.

Automobile Mechanics

In general, automobile mechanics inspect automobiles, diagnose problems, and carry out repairs, though not all mechanics perform all these tasks. Mechanics are usually divided into grades or levels. One employer, for example, had several teams of mechanics, each with an apprentice technician, a technician, a lead technician, and a team leader. All of these do repair work, but neither the apprentice technician nor the technician do diagnostic work, most of which is done by the lead technician. Meanwhile, the team leader, in addition to diagnosing problems and carrying out repairs, is also responsible for keeping up to date on technical service bulletins, scheduling work, and supervising and managing the team. Although other employers may call these positions by different names, this is a fairly typical arrangement.

As a result, the training and experience required of automobile mechanics varies. Employers generally do not have educational requirements, and backgrounds range from less than 12 years of schooling—particularly in the case of older workers—through community college. Employers often mention secondary vocational education programs as a source for beginning mechanics.

DIAGNOSTIC COMPUTER

For all but the lowest grades, employers require automobile mechanics to be experienced. To carry out valid state inspections, the State of Virginia requires a mechanic to have at least two years of experience, and at the highest level, employers usually require five years of experience or more. Although nine of Virginia's community colleges offer a certificate in automotive mechanics, few employers require a mechanic—even a master mechanic or team leader—to be certified. While certification may be preferred, experience and a good work history can substitute.

The major source of training for automobile mechanics is often on the job. Trainees may be sent to a service school run by an automobile manufacturer and also work as apprentices and helpers to more experienced mechanics. Mechanics at all levels may also be required to attend special courses that last as long as a week.

In addition to their technical skills, employers want mechanics who are responsible, dependable, and able to deal with customers, and apparently such people are difficult to find. Although the degree of shortage varies from place to place, in general, employers have a hard time finding good, experienced mechanics. There is, in fact, enough competition for such people that smaller employers may be at a considerable disadvantage because they are often unable to meet the salary levels and benefits offered by larger establishments.

For automobile mechanics, technological change is constant. Employers point out a number of new developments: fuel injection systems, digital components, new types of carburetors, pollution control devices, and others. In addition, computers have become part of the automobile mechanic's work in two ways. First, computers installed in cars need to be serviced. Mechanics usually take a short formal training course that teaches them to replace circuit boards and carry out similar repairs. Second, computerized diagnostic equipment has been available for about ten years but requires no special training. *"They take home the manuals and read them,"* one employer said.

As in many other occupations, the major non-technological change that has occurred for automobile mechanics is in the area of interpersonal skills. Before the advent of the team system, most mechanics worked alone or as a member of a teacher/apprentice pair. Now that many work in teams, new kinds of interpersonal skills are called for, particularly on the part of the team leader—who must coordinate the efforts of the others, facilitate communication, make decisions, and settle disputes—but also on the part of the team members, who must carry out their functions cooperatively. In addition, the sophistication of customers has been increasing, and as a result, mechanics need to answer more questions, be able to explain what they have done, justify their estimates, and in general become more involved in customer relations than before. All of this requires interpersonal skills of a kind not formerly required in this occupation.

Despite these changes, employers do not believe the automobile mechanic's job will change much in the future. Annual changes in automobile models have helped accustom mechanics to change. Good mechanics do not seem to have many problems with new technology, whether it is in the form of a new fuel injection system or a new diagnostic tool.

Maintenance Mechanics

Maintenance mechanics generally work in manufacturing plants, where they repair and do preventive maintenance on plant machinery. They may also fabricate parts for the equipment. In some plants they are responsible for the building or buildings as well; in others, they are responsible only for building maintenance, including repairing wiring, tending the heating and cooling system, and even doing carpentry.

Some employers require that a maintenance mechanic have a high school diploma. Others have no educational requirements. Training can be acquired in a number of ways: apprenticeship programs, usually lasting four years; community college or proprietary school programs in machine operation or a related area; or on the job.

Except for apprentices, employers generally want maintenance mechanics to have had experience, ranging from three years to "*the more the better.*" Nonetheless, because equipment varies so widely from industry to industry and even plant to plant, employers frequently cannot find mechanics with experience on the actual machines they will be maintaining. Consequently, employers usually offer considerable on-the-job training. This is sometimes the case even where there is an apprenticeship program, since the program may not supply enough mechanics to fill all available positions. In this situation, employers usually require mechanics with either formal journeyman credentials or equivalent training, and follow it up with training on the plant's own equipment.

In addition to experience and mechanical skills, employers also want mechanics to be reliable, have a good safety record, and be able to get along with fellow workers. These characteristics, however, are not as difficult to find as experience on specific machines.

Some employers have also had problems with technological change, not in the tools that maintenance mechanics use, but in the machinery they repair and maintain. These problems have not been universal, but where they do occur, they can be quite severe: one employer said that of nine attempts to retrain older mechanics on new equipment, only one had succeeded. Others say that they have not had problems so far but anticipate them when new machinery is introduced in the near future. New machinery that is considerably different from the older version simply exacerbates the problem of finding mechanics with appropriate experience.

As a result, employers indicate that while the basic nature of the maintenance mechanic's job is not expected to change greatly, they will be looking for people who *"can think logically"*, and are thus able to generalize their basic skills to new machinery. Reasoning, adaptability, and flexibility will be increasingly important in successful maintenance mechanics.

Office Machine Servicers

Office machine servicers maintain, diagnose, and repair a range of machines, among which are copiers, typewriters, calculators, cash registers, and increasingly, electronic word processors. They often work either for a company that both manufactures and sells equipment or for a retail outlet that includes a service department, but much of their work is done at the establishment that owns the equipment.

Employers want their servicers to be high school graduates. Since servicers represent the company to the public, they are expected to be personable, tactful, and able to communicate with others. Some employers want repair people to function as sales people as well. That is, a servicer should be prepared to inform the customer about new equipment and must be familiar enough with the company's range of products to discuss them knowledgeably and recommend them appropriately. Prior experience is not required; because the knowledge the servicer needs is specific to the equipment the employer sells and services, employers offer on-the-job training.

The transformation of the mechanical office into the electronic office has greatly affected office machine servicers. One result has been a shortage of job applicants with a background in electronics. Another has been an increase in the reliability of office machines. As a result, most servicers now provide maintenance and repairs to more customers than they did before. Still another result of change in office machinery has been the systems orientation of the equipment. For example, while typewriters are stand-alone machines, electronic word processors can be linked to peripheral devices such as printers and modems, to other processors, to computers, or to combinations of these. In their service capacity, people who repair office machines must therefore be able to diagnose problems that can occur anywhere in a system rather than in a single piece of equipment. In their sales capacity, they should be sufficiently familiar with the variety of possible linkages to be able to suggest such arrangements to the customer.

Consequently, with the advent of the electronic office, the repairer's job has become more complicated. Since word processors are really a specialized form of microcomputer, the office machine repairer's job has come to involve some of the same skills as those required of a person who repairs computers. Employers predict that these changes will continue, and training in both electronics and sales will be valuable assets for people interested in this occupation.

Refrigeration and Air Conditioning Mechanics

Refrigeration and air conditioning mechanics install, maintain, and repair cooling machinery, including standard units, heat pumps, and solar equipment. Some of the devices are electronic, and the mechanic must also be able to install and replace solid state control boards for such equipment.

Training in course work relevant to these tasks is available at the community college level, and employers tend to prefer a job candidate who has an Associate degree in this area, or at least has taken some courses. Some employers will hire people without this background as helpers or laborers who—if they prove themselves reliable and competent—will be eligible for promotion once they have gained some experience. Employers who hire people under this system may not even require a high school diploma.

Although a mechanic in this area may not be required to have many years of formal education, there is considerable on-the-job training. Some employers will consider hiring only experienced mechanics, but many hire people at a relatively low level, and provide them with both formal and informal training. Formal courses may be offered by companies that manufacture the equipment, schools that offer adult vocational education programs, or private trade and technical schools. Employers send trainees to all these institutions, and the combination of formal and informal training can last as long as three to five years.

Partly because of the length of training required and partly because the supply of refrigeration and air-conditioning mechanics is low, employers have some difficulty finding good job candidates. They say that most good people—those who have the skills and are dependable and hard-working—are already employed or have started their own businesses.

Employers agree that the technology used by new refrigeration and air-conditioning equipment represents a significant change, but they differ about the degree to which the use of electronics has affected the mechanics who install and repair this equipment. Some say it has simplified repairs: instead of being repaired by the mechanic, the defective boards in electronic equipment are simply removed, replaced by new ones, and sent to the manufacturer for repair. Most employers, however, believe that the new technology requires a really good mechanic to have a better understanding of electronics.

So far, this has not seemed to cause serious problems. Manufacturers have an interest in training mechanics on the new equipment, since inadequate repairs can reflect badly on the manufacturing company's reputation. There is also a tendency for more experienced and newer employees to engage in informal, reciprocal education. The senior mechanic teaches the skills needed for installation and repair; in return, the mechanic right out of school teaches the senior mechanic about electronics.

Employers do not agree about future needs in this area. Some believe the major technological changes have already taken place. Others, however, believe that change will continue at an even more rapid rate, and that the educational requirements for the mechanic's job will consequently increase. These employers believe that rapidity of change and increasing technological sophistication will require higher-level reading skills, as mechanics will need to read and interpret increasingly difficult instructions and manuals. New fuel sources, such as solar energy, could change the technology of refrigeration and air conditioning almost completely, requiring the mechanic to learn an entirely new set of skills. In general, whether the requirements for this occupation will change depends on how new technologies are developed and how rapidly and widely they spread. Given their recent experience, however, employers do not foresee adjustment to technological change as a major problem for this occupation.

Repair Summary

We were tempted to think that since equipment in almost all industries, firms, and agencies is changing rapidly, the jobs of those who repair this equipment would also be changing rapidly. However, we found this to be true only in some cases.

Clearly, equipment is changing, and those who repair it must therefore learn to deal with new technologies. However, in many environments repair work has always been highly equipment specific. Variation among makes of machines and among the models of a single manufacturer has always been considerable. Details, even among machines of the same general type, have for some time varied enough from model to model and year to year that the people who repair them have often been trained not only on a specific piece of equipment but also on the equipment made and sold by a particular firm. Thus, automobiles are increasingly repaired in the service department of a dealership devoted to one or two makes of cars, and garage owners who do not specialize have expressed problems in finding mechanics who are familiar with more than a few makes.

Office machine repairers are an exception. In this occupation, change has not been a significant problem precisely because it has been so radical. First, the skills involved in repairing mechanical equipment—typewriters, for example—are not applicable to repairing electronic equipment. Second, the electronic office now contains many more pieces of equipment than it used to. As a result, many of the people who repair office machines are products of new training rather than retraining. Significantly, employers did not mention the problem of the older worker—for example, the person who repairs typewriters. This omission probably results from much of the older equipment persisting even in the new environment, and it may be that the older equipment and the older worker will retire from the work force at the same time.

In service and repair occupations in general, however, learning the job is largely a matter of in-house and on-the-job training, and employers do not expect this situation to change very much. As the equipment changes, it is probably true that, as some employers said, learning from manuals will become more important. People who work in this area will be required to have better skills in reading technical material and interpreting diagrams in order either to learn new equipment on their own or to take the fullest advantage possible of ongoing in-house or manufacturer-sponsored training programs.

However, as in many other occupations, employers are increasingly asking that their repair people be good at working with others as well as in representing the business to customers. Finding people with these skills seems to be more of a problem in this area than in some. Traditionally, the people who have chosen this line of work are interested more in working with machines and equipment than with people. Consequently, asking people in some of these jobs to function as company representatives and/or salespeople amounts to requiring a new set of skills.

Finally, employers are not clear in their own minds about the extent to which new technology will require new background skills in this area. Electronic technology can simplify jobs by making repairs a matter of pulling one board and replacing it with a new one. On the other hand, diagnosing problems may require some knowledge of the technology and how it works before the repair worker can know which board to pull. Employers seem to share a general feeling that a background in electronics can be useful and that this, together with the requirements for more literacy and better human relations skills, may come together in a requirement for somewhat higher educational levels.

Engineering and Related Occupations

	Employment		1980-90 Change		
Occupation	1980	Projected 1990	Numeric	Percent	Average Annual Openings
Electrical Engineers	10,701	15,878	5,177	48.0	741
Electrical and Electronic Technicians	9,304	13,370	4,066	44.0	549
Drafters	6,242	8,363	2,121	34.0	333
Civil Engineers	4,404	5,734	1,330	30.0	272
Mechanical Engineers	4,362	5,822	1,460	33.0	232
Total	35,013	49,167	14,154	40.0	2,127

In general, engineers design and test machines, equipment, and constructions, such as bridges. They are usually highly specialized. In Virginia, only three of the 25 or so specialties recognized by professional engineering societies are important enough to be included in this study. These are civil, electrical, and mechanical engineers. Also included in this group are two important engineering-related occupations, electrical/electronic technicians and drafters.

In addition to design, engineers may work in many other capacities within their specialty, including maintenance, supervision, administration, and sales. However, design remains the core of engineering occupations. Engineers produce designs either in the form of rough drawings or sets of specifications. Drafters use these to construct drawings that will be used as the basis for manufacture. Meanwhile, the duties of technicians overlap with those of both engineers and drafters. In fact, engineering personnel are increasingly organized into teams that often consist of one or more of each of the three levels of workers. Within them, occupational lines are sometimes not as clear as they have been traditionally.

The computer, and CAD/CAM (Computer-Aided Design/Computer-Aided Manufacture) in particular, has been both the largest source of much technological change in engineering and the reason that occupational lines are no longer as clearly drawn. For example, the drafter was once the only person who produced working drawings. Now, however, CAD has enabled the engineer to produce drawings that may need only a minimum of alteration to transform them into final form.

The concentration of high technology industry and consulting firms in Northern Virginia accounts for the relative concentration of engineering-related employment in that area, where 41 percent of Virginians in these five occupations worked in 1980. Across the State, these occupations employed about 35,000 in 1980 and are expected to grow to just over 49,000 in 1990, an increase of 40 percent. Electrical engineers are projected to have the largest increase in the group and to grow the fastest; civil engineers are expected to show the smallest gain, although even in this case over 1,300 new positions are expected to be added.

Electrical Engineers

Nationally, electrical engineers work in many settings. In Virginia, the three largest industries employing electrical engineers are the federal government, business services, and firms providing engineering, architectural, and surveying services.

Electrical engineers propose new products for development; design and develop them; provide drawings, specifications, parts and lists for product manufacture; develop instruction manuals and other kinds of technical documentation; determine whether the product will work in the customer's environment; and oversee its installation.

Employers require electrical engineers to have a Bachelor of Science degree in the field, preferably from a well-respected engineering school. Some encourage more advanced degrees; others do not. In either case, employers expect engineering schools to provide the basic skills of the profession, among which is computer programming. Beyond this level, employers provide on-the-job training in the skills needed by their particular industries, often by assigning the beginning engineer to work on a team under the guidance of someone more experienced.

Some engineers train in cooperative programs, in which students work part-time while attending school. Employers often prefer beginning electrical engineers who have either trained in these programs or who have had summer jobs in the field. Employers also look for candidates who can demonstrate ingenuity, creativity, and self-motivation and are comfortable working as team members.

Whether employers have difficulty finding beginners with the training and other qualifications they need depends on both the geographical area in which the firm is located and the kind of product it deals with. Many employers must compete nationally for the best young engineers. As a result, in some areas where the prevailing salaries are low, it is difficult to attract the most promising candidates. In addition, some employers find that job candidates lack background courses in such areas as radio engineering, antenna design and theory, and microprocessors, and that in general formal training tends to be behind the times in comparison to the demands of the job.

Recent developments in electronics have had a considerable impact on electrical engineering. First, the nature of the products designed by the engineer has changed. For example, digital controls and switches have increasingly replaced analog devices, and the advent of the microchip has meant that circuitry must be designed to perform more tasks within an increasingly small environment. Second, the engineer's tools have changed. Instead of building models, the electrical engineer is more likely to work at an engineering work station, using a sophisticated microcomputer to model and refine the product design.

In fact, the field of electronics is changing so rapidly that people who employ electrical engineers regard the future of the occupation as unpredictable. While demand for electrical engineers will continue at a high level for some time to come, the evolution of the technology is generally regarded as too open-ended to predict. If we are, as many employers believe, at the beginning of the electronic revolution, then in the future, electrical engineers will need to update their educations constantly. Fortunately, as one employer said, *"electrical engineers are always fascinated by new things."* There have, however, been a few problems with older engineers who have not kept up to date, and the problem of keeping up may well prove to be an important one in the future.

Electrical and Electronic Technicians

Electrical and electronic technicians hold a variety of jobs in industry. They may work in firms that design and manufacture complex electronic equipment, or in radio or television, or for the government. Where they participate in research and the development of new products, their tasks may overlap considerably with those of the electrical engineer. In other environments, they may install, service, and/or repair electronic equipment ranging from fire alarm devices to sophisticated electrical and electronic systems. Finally, they may also work as sales representatives.

Unlike electrical engineers, electrical and electronic technicians are not required to have college degrees. Their formal educational training may come from secondary or postsecondary vocational education, private trade and technical schools, the government-sponsored training programs, and military service. Some employers have cooperative programs with local community colleges, in which the technician receives two years of training followed by an apprenticeship at the firm. Almost all employers provide extensive on-the-job training, often in formal classes that may be held on site or in the parent company's training facility. Frequently employers also encourage technicians to continue their education by taking classes at a community college or other postsecondary facility.

Good grades, communications skills, and a background in mathematics and science are all factors employers look for when hiring electrical and electronic technicians. They should be able to read well and write clearly, should be innovative and self-starting, and must be able and willing to learn.

Most employers seem to be able to find good technicians, but some do have problems. One small employer had difficulty finding people who were trained to service old as well as new equipment. A different problem existed in a larger firm that had its own training program. Here, the number of technicians needed was greater than the number of training positions available. To fill these positions, the employer had to hire from outside the company's training program people who were judged to be less qualified than those who had been trained in the company's own facilities.

Technological change in electronic systems has affected these jobs considerably, but the pace of change is not really a problem. Summing the question up, one employer laughed and said *"Technicians are the kind of people who like this stuff."* In the area of non-technological change, one employer felt that the decrease in the amount of mechanical ability needed to carry out the job was the explanation for the increased number of women entering the field. Another said the firm was increasing the duties and responsibilities of technicians and that researchers were becoming aware that the more they involved the technician, the more useful the technician became.

As for the future of the job, the outlook for the number of positions available is good. There may be increased specialization within the job, and the pace of technological change is expected to continue, but employers do not foresee any basic difference between the technician of the year 2000 and the technician of 1985.

Drafters

In general, drafters translate designs produced by scientists, engineers, and others into detailed drawings and specifications that are used as guides for manufacturing or otherwise producing the object. Some drafters may also carry out associated tasks, such as providing cost estimates. They may work in a variety of industries, among the most important being engineering firms, architectural establishments, and companies that manufacture durable goods.

Educational requirements for drafters range from vocational education training in high school to a high school diploma to two years of technical school or other postsecondary education. Employers mentioned a variety of educational backgrounds for the drafters they employ, including public secondary and postsecondary vocational education, private trade and technical schools, and four-year colleges. Wherever the training was obtained, employers expect it to include basic drafting skills as well as a grounding in geometry, trigonometry, and general mathematics.

Whether an employer requires experience when hiring a drafter depends on the level of the job. Experience is seldom required for an entry-level drafter, but there is often extensive on-the-job training, either in formal courses, as an apprentice to a senior drafter, or both. Some employers also offer extensive continuing education programs for drafters, sometimes taught on-site by local colleges and universities, sometimes available via the electronic classroom. One firm, at least, encourages drafters to take this course and offers a tuition reimbursement program for those who do.

Employers' opinions about the difficulties of finding good job candidates in drafting are mixed. First, they agree that in addition to their technical skills, drafters should be dependable, responsible, and interested in self-improvement, but they differ on whether it is hard to find people with these qualities. Second, in some areas such as civil engineering, employers say that prospective drafters do not have the drawing skills required for this kind of specialization. Even an employer who said that finding drafters with the requisite abilities and characteristics was not difficult added, *"not if you keep looking."*

The degree to which Computer-Aided Design (CAD) has affected drafters depends upon the degree to which it has penetrated the environment in which they work. In some small establishments, drafters still execute drawings by hand. In some large ones, conversion to CAD is virtually complete. In these jobs, drafters make only preliminary, freehand drawings, using them as a base on which to develop detailed specifications. They then enter these specifications into a computer, which produces the final drawing. At the most advanced level, in fact, the process of translating design specifications into products involves no drawing at all. Instead, the specifications are stored electronically and used to control the machinery that creates the product.

Although few Virginia firms have reached this level of automation, employers agree that by the end of this century a drafter who produces drawings by hand will be a rarity. They do not agree on whether there will be any such job by then. Most think that drafters will continue to exist as technicians who use computers to generate the outputs required for production but do not execute drawings directly. This point of view is in accord with the OES projections for drafters, which show an increase. However, it is also possible that designers will begin to enter their designs directly into the computer themselves, thus eliminating the drafter's position as the link between the designer and the production process. Particularly in small firms, this alternative could be extremely cost-effective, and as a result the demand for drafters could fall considerably.

Civil Engineers

Civil engineering is the oldest branch of the field of engineering. Civil engineers design and supervise large-scale construction projects, including drainage and sewer systems, roads, commercial developments, bridges, and the like. Most of these are public or quasi-public facilities. Civil engineers may work for private firms or government agencies or as consultants. Many spend at least part of their time in administration.

Like other engineers, civil engineers undergo considerable postgraduate on-the-job training. As one employer told us, *"You can't expect anyone straight out of school to be able to do anything because they have no applied knowledge."* This is particularly true in civil engineering because it involves supervising contractors and other construction workers in the field. In addition, because the projects are often large-scale, the civil engineer must frequently coordinate the requirements, rules, and regulations of a multitude of government agencies.

The basic requirement for entering the field of civil engineering is a Bachelor's of Science degree from a school of engineering. Beyond this, employers look for a person who can relate to people, and—in the case of consulting firms—act as a salesperson as well. Above all, beginning civil engineers must be able to apply the theoretical knowledge they have gained in college to on-the-job situations, yet in the opinion of some employers, they have not been taught to do this, *"largely because their teachers never had any applied training either."*

The computer is the primary source of new technology for civil engineers, enabling them to reduce markedly the time involved in producing preliminary drawings and carrying out calculations. The transition to computer technology has not been a problem, since it is one area in which training seems to be keeping up with developments in the field. For some employers, however, demands for increased skills in communication, both oral and written, are causing problems. As regulations become more numerous and complex, the engineer must be able to communicate with the representatives of regulatory agencies. Engineers must also convey increasingly complex instructions to those who oversee construction, as well as communicate with prospective customers. These skills are not part of the engineering curriculum, nor do employers necessarily think that they should be. Employers do, however, want their beginning engineers to have learned to speak and write clearly, perhaps at the secondary school level, before they enter professional training. Finding and keeping good engineers who have these additional skills is a problem.

Employers do not foresee many changes in the civil engineer's job. The major change—microcomputer use—has already occurred. Computer software will continue to grow in sophistication, and the materials and processes that go into construction will continue to change. Both of these changes have been going on for some time, and engineers are accustomed to the need for adjustment in these areas. Employers consider the growing need for interpersonal skills more important than the need for new technical skills.

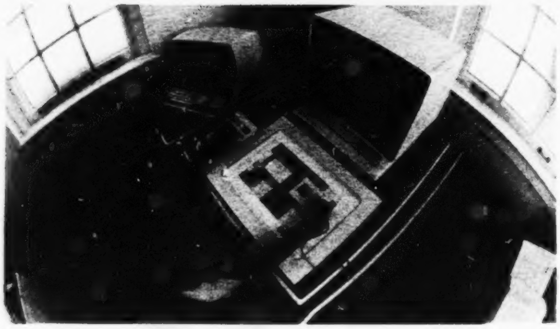
Mechanical Engineers

Mechanical engineers design and develop machines that produce or use power. These include a variety of devices—power-producing engines and turbines, power-using refrigerators, elevators, and industrial production equipment. Like other engineers, they are usually specialized, either in one or more kinds of machinery or in machinery associated with particular industries.

Not all mechanical engineers have engineering degrees. While most employers require that a mechanical engineer have at least a Bachelor of Science degree in the field, one employer indicated that it is also possible to be promoted into the job after lengthy experience—as much as 10 to 15 years—in mechanical design. In this firm, the entry-level design position might be the job of the drafter, but a promising candidate for promotion would spend only a few years at this level, and if successful could expect eventually to hold the job title of mechanical engineer. People who have achieved this level have received their initial training in vocational education programs, private trade and technical schools, and community colleges. They work under the nominal supervision of certified graduate engineers, but in all other respects they have professional responsibilities.

Like employers of civil engineers, employers of mechanical engineers do not necessarily look for previous experience when they hire mechanical engineers, partly because the work is often specialized and the chances of finding people with pertinent experience are relatively low. For example, one employer said that *"an engineer right out of school is virtually worthless . . . It takes a minimum of a year [of on-the-job training] before we can get some return on their efforts, and to get a full payback it takes between three and four years."* As a result, where firms participate in cooperative programs with engineering schools, they prefer job candidates who are the products of these programs. In other companies, mechanical engineers, like electronic engineers, serve what amounts to an informal internship or apprenticeship, working under the guidance of a senior person who acts as teacher and mentor.

Mechanical and electronic engineers differ in the kinds of devices they design, but in other ways the fields are similar. Employers look for essentially the same personal characteristics in both, and both fields have been heavily affected by computer technology, particularly in the area of computer-



assisted design. As a result, employers want engineers who are not just computer literate but can write their own programs as well as operate complex software written by others.

In the future, employers say, mechanical engineering will make even more use of computers, particularly in CAD/CAM. In addition, design problems in the field will call for increasingly complex solutions, and some employers are looking toward hiring mechanical engineers who also have some knowledge of electrical engineering. Because more mechanical devices are incorporating electronic components, the line between mechanical and electronic devices is no longer absolute. Consequently, the line between the kinds of engineers who design the devices is less clear than it has traditionally been. Nonetheless, business and industry will continue to need the devices that mechanical engineers design, and the occupation is expected to be one in which demand for good people continues to increase.

Engineering Summary

As might be expected in a highly technological field, the technology associated with electronics has had a considerable impact on all engineering occupations, bringing greater efficiency to the field and expanding its scope. The new technology has also begun to erase the distinction between traditional engineering specialties, and between engineering, technician, and drafting jobs. For example, because so many devices now incorporate electronic components, employers' requirements of mechanical engineers may well begin to include a considerable body of expertise that was once the sole province of electrical engineers. Meanwhile, in the work place, teams of engineers, technicians, and drafters work together, using advanced computer technology that permits technicians to do some tasks that were formerly done only by graduate engineers and graduate engineers to turn out drawings that were formerly done only by drafters.

Because engineering is such a specialized field, employers say, no undergraduate curriculum can produce people with the expertise actually needed on the job. On-the-job training is common and ordinarily lasts for more than a year, often under a system of informal apprenticeship.

In a new area of skills, employers are increasingly demanding that their engineering personnel be able to communicate and get along with people. Sometimes this is the result of their being required to work in teams, sometimes of needing to supervise the work of others, sometimes of having to work as consultants selling services and performing them for clients who are not necessarily technically oriented. Communication skills, where they are needed, constitute more of a problem than technological change.

Technology is something with which engineering personnel are familiar and comfortable. They have usually chosen the field because of their interest in changing technology and are trained to adapt to such changes. However, as employers told us, engineers are not always trained to be successful team members, salespeople, supervisor/administrators, and communicators. Yet these functions are becoming an integral part of many of the jobs in the field.

Production Occupations

Occupation	Employment 1980	Employment Projected 1990	1980-90 Change Numeric	1980-90 Change Percent	Average Annual Openings
Welders	12,002	14,783	2,781	23.0	522
Electricians	14,452	16,016	1,564	11.0	482
Electrical and Electronic Assemblers	4,233	6,260	2,027	48.0	317
Machinists	5,103	6,162	1,059	21.0	247
Shipfitters	2,606	3,437	831	32.0	143
Total	38,396	46,658	8,262	21.5	1,431

Four of the occupations included in this group—electricians, machinists, shipfitters, and welders—do skilled production work. Electricians also do repair work, some as employees of establishments that specialize in repairs, some as proprietors of their own businesses. People in these occupations may not necessarily need a high school diploma, but they often undergo training—in apprenticeship programs, on the job, or both—that extends over several years. The fifth occupation, electrical/electronic assembler, is included here because it is a production occupation, but this job requires much less skill and training than the others.

Shipbuilding, the largest manufacturing industry in the State, employs all of the occupations in this group. Since the shipbuilding industry is located in the Hampton Roads area, large concentrations of these occupations are found there. The distribution of electricians and welders who do repair and construction work is, on the other hand, much wider. Small establishments offering these services can be found almost anywhere.

Between 1980 and 1990 the number of people employed in these production-related occupations is projected to increase by over 20 percent, somewhat below the rate of growth projected for all wage and salary employment in Virginia. Of the five occupations, electrical and electronic assemblers are projected to show the largest percentage gain, 48 percent, although some employers believe that if the trend toward automating this occupation continues, these projections might need substantial downward revision. Welders are expected to add the most jobs, nearly 2,800; machinists are expected to add the fewest. Overall, these production occupations are expected to increase annually by over 1,400 people per year between 1980 and 1990.

Welders

Welders use equipment that cuts or joins metal or plastic parts. They may work on assembly lines, in shops, at construction sites, or in any other environment where these processes are needed for production. They may also work in small shops that do repair work involving metals or plastics.

Welding involves many different processes. In fact, the American Welding Society recognizes more than 80 of them. Welding can be done with hand-held torches or in vacuum chambers by electron beams. The range of welders' tasks depends on the employing establishment. Sometimes individual welders must be able to do several kinds of welding; sometimes they do only one kind; and sometimes they do only the simpler kinds, leaving processes like electron beam welding to electronic technicians.

Welders learn their trade in secondary vocational education courses, the military, or apprenticeship programs. The amount of experience they must have varies among employers, but usually they must have some knowledge of welding before they are hired. Along with this knowledge, employers look for manual dexterity and coordination, willingness to learn, dependability, and compatibility with co-workers. If pay scales are competitive employers have no problem finding good employees.

Welding technology has changed considerably in the recent past, becoming an increasingly complex and technical trade. Both the materials to be welded and the processes used have changed, and employers expect both changes to continue in the future. Automation has introduced equipment that requires new skills. Instead of controlling the equipment manually, many welders must now be able to calibrate the controls of automatic equipment.

These developments have caused problems for some employers, partly because welders have resisted some of the new techniques and partly because training has not kept pace. In the future, employers say, welders will need higher levels of literacy, familiarity with electronics and quantitative methods, and more specialization. These skills will need to be included in training programs at all levels.

Despite the publicity given to robotic welding as a cause of unemployment in this occupation, welding will probably continue to be important in Virginia. Unlike semi-automatic and automatic welding, robotic welding replaces the welder with a machine, but in many of Virginia's industries—shipbuilding, for example—robotic welding is inappropriate. Other welding is done in small shops and plants that cannot afford this technique. Consequently, during the coming years, the number of welders in Virginia is expected to grow.

Electricians

Electricians install, maintain, and repair commercial and residential wiring systems, electric motors, and other apparatus. Since electricity is the basic power source throughout the economy, electricians work for a variety of establishments, firms, and agencies, both public and private.

Being an electrician requires considerable training. People with no experience may be hired as helpers or enter apprenticeship programs, some of which are run cooperatively with community colleges. People enter these programs from many educational backgrounds, including secondary vocational education and government-sponsored training programs. Apprenticeship programs generally last four years and lead to a journeyman's card.

Few employers will hire completely inexperienced people as electricians, and when they do, the duties are usually not those that would be required of a fully qualified person. Other employers, particularly those that are too small to run their own apprenticeship or training programs, will only hire people who already have a journeyman's card. State certification is often required in addition. Certification in turn depends on either the successful completion of an apprenticeship program or four years of supervised work experience. In either case, the electrician must also pass a state examination. Finally, some employers accept military training as a substitute for completing a formal apprenticeship program. Given the formal skills of the trade—however they were obtained—the personal qualities that employers look for are job stability and good work attitudes.

Whether the electrician's job has changed and whether employers expect it to change in the future depend largely on the degree to which particular employers have expanded the job to include electronics. In some cases, electricians have begun doing tasks that are more often assigned to electrical and electronic technicians. If an electrician is doing many such tasks, this kind of change amounts to a redefinition of the job. Other employers keep the two jobs strictly separated and plan to continue doing so.

As long as electricity remains the basic power source it is now, electricians will be in demand. The extent to which the job may change, however, is unclear. The degree of change will probably vary according to a number of factors, including the size of the establishment and the industry in which the electrician works. In small establishments, an employer may find it cost efficient to combine work with electricity and electronics into a single job. In larger ones, specialization will probably remain. Meanwhile, at least some employers say they plan to look for electricians who have had experience in electronics. Employers also would like to see electricians' training include more acquaintance with the elements of electronic technology.

Electrical and Electronic Assemblers

Electrical and electronic assemblers put together electronic components. For example, they may insert components into circuit boards and solder them or do final assembly on instruments such as telephones. Requirements for the job vary from *"the ability to read and write"* to a high school diploma and/or two years of electronics courses. Similarly, people who hold these jobs come from a variety of backgrounds, including high school, government-sponsored job training programs, private trade and technical schools, and community college programs. Variety also characterizes the amount of training provided by the employer, which can range from almost none to two years of informal training, *"learning the ropes."* No previous experience is required for the job, though in some plants assembly experience makes a difference in pay.

Employers want assemblers to have sufficient mechanical aptitude so that *"they know a good job from a poor one."* They also agree on the importance of good work attitudes. As one employer said, *"Attitude is almost as important as aptitude."* Currently the number of suitable job applicants is sufficient, and sometimes more than sufficient, to keep up with employers' demands.

Although projections based on past trends indicate increasing demand for electrical and electronic assemblers, some employers say that in their industries the job is disappearing as the result of changing technology. The assembly of electronic components is becoming more highly automated, sometimes to the extent that human hands no longer touch the product during the manufacturing process. Where this is happening, employers say, future need will not be for assemblers but for more highly skilled people who can monitor and trouble-shoot the automated equipment that has taken over the job. Where the job survives, some employers do not expect it to change significantly. Others, however, expect a trend toward more restrictive work conditions, such as moving lines and clean room environments, where work is more regulated and more similar to assembly line work than it has been.

Machinists

Machinists use raw metal stock and specialized machine tools to convert design drawings into the metal objects they represent. This process requires considerable knowledge, skill, and a number of steps. Machinists must have a working knowledge of mathematics and the properties of metals, as well as sufficient training to enable them to select appropriate tools, position and secure the material, and control the speed and feed of the machine in order to produce a product that meets design tolerances. Skilled machinists work independently, with a minimum of supervision.

Machinists must consequently be able to read and interpret drawings and blueprints. They must use mathematics to translate the specifications given on these plans into those required by the precision tools they use. This is highly skilled work, often learned in a formal apprenticeship program leading to State certification. These programs often require a high school diploma, and many machinists start their career paths in secondary vocational education programs. Others have attended public or private adult vocational education courses, received training in government-sponsored programs, or taken classes in community colleges.

Technology is having a considerable impact on machinists. Their equipment is being increasingly computerized, and as a result the machinists need to do less calculating and decision-making. However, employers do not agree about the impact this change will have on the level of skill that machinists require. Some believe that the level will decline to the point where the machinist will become a machine operator. Others expect their machinists to learn to program the equipment. However, employers do seem to agree that educational levels for machinists will increase, and that employers will look for people who are computer literate and have the skills to set up and control electronic equipment. It would appear, therefore, that the occupation will continue to be a highly skilled one but that the emphasis will shift away from mechanical ability and toward the more abstract skills involved in programming and calibrating computerized equipment.

Shipfitters

As one employer said, "*a shipfitter is to a ship what a carpenter is to a house.*" Shipfitters assemble individual metal components, including steel plates, T-bars, elbows, and I-beams, into a unit and tack weld units into place on the frame of a ship. In some shipyards, the shipfitter may also do the final welding; in others, welders perform this function.

Although shipbuilding is a highly localized industry, the size of the company can vary from one that employs upwards of a thousand shipfitters to one that employs considerably fewer than a hundred. Where the company is sufficiently large, it may have a comprehensive apprenticeship program that trains people for many occupations, including shipfitting. Such programs combine classroom, on-the-job, and off-site training into a program that lasts for several years. Upon completion, apprentices become journeymen and are assigned to work under the supervision of a more experienced person.

Sometimes, larger shipyards also hire inexperienced people outside of the apprenticeship program, assigning them to jobs where they work under experienced supervision. However, in smaller shipyards employers say they do not have training facilities and generally hire people who have apprenticed or trained in a larger yard. Both stress that shipfitters must have physical strength and endurance as well as manual dexterity and the ability to read blueprints. Neither kind of employer has trouble finding qualified people for the work.

Shipbuilding is a difficult industry to automate. Components are large, and most work is done in place on the ship itself. One innovation is modular ship construction, and employers say this will require less reliance on craftsmanship and more on the ability to read and comprehend complex technical instructions and to carry them out with sufficient accuracy to meet preset standards. Such modular construction is the major way in which the shipfitter's job will be changing in the future.

Production Summary

In Virginia, few production occupations meet our two study criteria of employing large numbers of people and involving changing job skills. The five that we included in this study are diverse. One—electrical and electronic assembly—is virtually unskilled. Its future is in doubt, and whether it survives as a significant occupation depends upon the degree to which automation penetrates the manufacture of electrical and electronic equipment in this state. Another, machining, is highly skilled and in the process of undergoing considerable change as the result of increasing computerization.

Both electrical/electronic assemblers and machinists usually work only in large establishments. Two others of the production occupations we have included—electricians and welders—work in establishments of all sizes and in a range of industries. Electricians may make repairs in private homes or install wiring in large manufacturing plants. Welders may work in small body shops, repairing automobiles, or in shipbuilding. Electricians are highly skilled, but most employers do not expect them to be greatly affected by technological change in the near future. Welders, on the other hand, have been greatly affected by technological innovation.

Finally, shipfitting is an occupation that is important in only one geographic area of Virginia. Like welders, electricians, and machinists, shipfitters receive extensive training, often in apprenticeship programs in the companies for which they will work. Technological change has only moderately affected shipbuilding, and the pace of change is not expected to increase appreciably. Machinists, welders, shipfitters, and electricians, then, lie along a continuum of changing technology, with machinists affected the most and electricians the least. For all of them, however, reading, interpreting, and following directions that can be quite technical and complex are part of the job and will be increasingly important. For most of these occupations, much of the requisite training is provided by apprenticeship programs. While we expect the content of these programs to accommodate to the changing technology of the jobs, its duration and organization will probably remain the same.

Eight Miscellaneous Occupations

Occupation	Employment 1980	Employment Projected 1990	1980-90 Change Numeric	1980-90 Change Percent	Average Annual Openings
Accountants	14,762	19,361	4,599	31.0	955
Librarians	4,685	5,645	960	20.0	321
Paralegals	1,440	3,151	1,711	119.0	249
Restaurant and Store Managers	31,969	41,707	9,732	30.0	2,361
Purchasing Agents	5,403	6,320	917	17.0	240
Construction Inspectors	2,071	2,634	563	27.0	146
Insurance Agents	6,411	7,623	1,212	19.0	322
Switchboard Operators	3,194	3,601	407	13.0	298
Total	69,935	90,042	20,107	28.8	4,892

This section contains eight occupations that could not logically be grouped elsewhere but are arranged as systematically as possible here. Nor will we try to draw any conclusions about such a disparate group.

The first three of these occupations—accountants, librarians, and paralegal aides—are specialized professional-technical ones. They are followed by restaurant and store managers, and then by purchasing agents and construction inspectors, whose jobs are management-related. Finally, insurance agents are sales workers, and switchboard operators are usually classified as holding administrative support jobs.

Employment in the eight occupations covered in this section, although found in all sections of the state, is generally concentrated in two metropolitan areas—Northern Virginia and Richmond. For example, over half of all paralegals in the state work in Northern Virginia. Purchasing agents are largely concentrated in the Northern Virginia area, while over a third of the state's insurance agents are found in Richmond. Both Richmond and Northern Virginia have sizable concentrations of accountants. These concentrations reflect the service-oriented nature of these two metropolitan areas.

Among these occupations, growth between 1980 and 1990 is expected to vary considerably. At one extreme, switchboard operators are expected to grow by only 13 percent, while the number of paralegals is expected to more than double. Store and restaurant managers, the largest of these occupations, are expected to grow by 30 percent, adding about 9,700 positions during the decade and offering over 2,300 openings each year.

Accountants

An accountant performs tasks involved with financial records. Depending on the nature of the firm or agency and the level of the job, accountants may keep general ledgers, prepare budgets and reports, analyze and set up accounting systems for clients, prepare individual and/or corporate tax returns and financial statements, and offer professional consulting services on financial management. They may work in government or in a private company or may be self-employed.

Employers generally require a beginning accountant to have a Bachelor's degree. Some require an undergraduate major in accounting; some specify a number of course hours in the field. The employers with whom we talked did not require accountants to be Certified Public Accountants (CPA's), but most would give preference to a person with certification. Some expect a junior accountant to pass the CPA examination within two or so years of employment; and in any case, certification is usually a necessity for advancement in the field. However, passage is not easy. Most candidates take the examination several times before passing it, and many need to take at least a course or two beyond the BA level to prepare them for the examination.

Accountants, therefore, generally have educational backgrounds of at least four years—and often more—of formal postsecondary study. Beyond this level, requirements and training differ. Some employers have entry-level positions for which they will hire candidates who have just graduated, while others require experience for any position. Similarly, some employers do not provide on-the-job training; others provide it informally; and still others offer formal, structured programs that last two to three years and award a certificate of completion. In the latter case, employees attend formal training as part of the job.

Accounting carries a good deal of responsibility, and employers quite naturally want employees who can work independently and take control of a situation. In addition, however, they stress the need for accountants to have the interpersonal skills that enable them both to work as part of a team and to deal successfully with clients. Thus, employers say, in addition to having accounting skills and being responsible, accountants should also be assertive, confident, and articulate.

Some employers find it difficult to locate good accountants. In government, pay scales are low relative to those in private industry, and although this does not seem to cause problems at the entry level, it makes it difficult to hire at the middle levels and above, and to keep promising people. Other employers believe that a broader liberal arts background would be helpful to accountants who need to communicate both formally and informally with clients about other than financial accounts.

The profession of accounting has been and is expected to continue changing in three ways. First, the use of microcomputers has brought considerable change as well as some problems. Basic accounting tasks are increasingly carried out using spreadsheet programs on personal computers. As a result, the time that accountants spend doing routine clerical tasks such as posting numbers has decreased. In some organizations, however, another result has been resistance, with a high proportion of accountants reluctant to learn the new technology.

The other changes that have occurred in accounting are similar to those that have occurred in many professions, namely the need for interpersonal skills and the move toward specialization. In a sense, the need for more interpersonal skills is itself a result of the introduction of new technology. As electronic data processing frees more of the time formerly accorded to routine tasks, the accountant, as the financial expert, becomes increasingly involved in management. This involvement, in turn, means that accountants are required to have more in the way of human relations skills in general, and management skills in particular, than was formerly the case. Specialization is also beginning to be important in accounting, and employers say that it will continue to increase during the coming years. Specialization can mean that the accountant concentrates either on a particular industry or on a particular function, such as strategic planning or financial projections.

As a result of these changes, most employers believe that educational and training requirements for accountants will need to be changed in the near future. These changes range from requirements that job candidates be thoroughly acquainted with electronic data processing to the expectation that the larger private firms will hire only accountants with specialized backgrounds in areas such as finance, marketing, and the like. They also mentioned the possibility of entry level apprenticeships.

Employers agree that although basic accounting procedures will not change much, by the turn of the century there will be little manual number manipulation left in accounting. Accountants may in fact be involved in selecting the hard and software that will carry out such tasks as posting journal entries and checking balances, thus becoming, in effect, systems analysts who specialize in accounting systems. Meanwhile, the need for communications and managerial skills will continue to increase.

Librarians

Traditionally, librarians have been involved in acquiring, classifying, storing, and retrieving information. Generally, they are specialized in one or all of three ways: first, according to the kind of library in which they work; second, according to the function they perform; third, according to the subject area with which they deal.

The type of library is fundamental. Librarians work in various settings, in organizations ranging from small elementary school libraries to large university research libraries. Increasingly, they also work in special libraries, many maintained by private companies for research by their own staffs. Within these organizations, librarians often specialize by function. Acquisitions librarians, for example, decide what materials will be purchased. Catalogers classify books and usually supervise a staff of clerical people. Reference librarians specialize in answering questions covering a range of topics and may sometimes need to go far afield to learn the answers.

In larger libraries, particularly in universities and special libraries, librarians may also specialize in particular areas of knowledge. A university library system, for example, may employ librarians specializing in law, medicine, engineering, and business, among other subject areas, as well as bibliographers who specialize in geographic areas such as East Asia, Latin America, Africa, and/or North America. University libraries often employ curators of special collections, which may range from the papers of famous authors, presidents, and other public figures to rare books and such esoterica as Tibetan manuscripts. Often curators of these collections have extensive knowledge of their subjects and work closely with students and scholars doing research in these areas.

The range of library work is thus considerable, and the degree of specialization varies with the size and type of the library. At one end of the continuum, school librarians, particularly in elementary schools, often carry out all the tasks involved in librarianship themselves. At the other end, librarians in large research libraries are extremely specialized, and may supervise staffs ranging from a single library assistant to a dozen or more professional librarians. Librarians who head departments or administer large public systems may play an important part in setting organizational policy. Public librarians sometimes find themselves in the center of public issues relating to free speech and censorship.

Consequently, the training necessary to be a librarian also varies. The basic qualifying degree for librarians is a Master's degree in library science, but this is not usually required for school librarians, who often must be certified teachers instead. Administrators of large libraries or systems, and people who teach in library schools, usually need a doctorate in the field. For many academic and special librarians, the demand is increasingly for people with two Master's degrees, one in a subject area and one in library science. Other skills required vary accordingly, from the ability to make reading attractive to elementary school students to an interest in serving the public to the administrative skills required to manage large budgets and staffs. Employers' lists of these skills range from *"you can just about take them out of junior high and make them a [school] librarian"* to *"some of our positions require reading knowledge of at least four languages and more would be better."*

The degree to which new technology has affected libraries and librarians also varies. For some time now, librarians have been dealing with information stored in other than printed form, including microfilm, tapes, records, and films. Within the past ten years, computer technology has become important in many libraries, both small and large. These systems not only make card catalogs obsolete and are used internally for data storage and retrieval, but also link libraries nationally, enabling librarians to carry out extensive bibliographic searches for materials held by libraries across the country. Many large libraries now employ automation librarians who are specialists in implementing and maintaining computer systems, and most library schools now teach courses in this area.

In the future, these developments will continue. Although librarians generally agree that the total replacement of books by other forms of information storage is something that will not occur soon, they also agree that at the present, libraries and librarians are in the midst of a transition to electronic automation that will ultimately affect the entire field. *"The hallmark,"* said one person we spoke to, *". . . will be flexibility. Librarians between now and 2010 will have to be more flexible than those before or after, because we are making the transition now."*

Paralegals

Paralegal personnel assist lawyers in ways that vary with the kind of law practiced by their employer or, in large firms, the department in which they work. They almost always organize files and cases, prepare forms and documents, and research cases. They may also represent the firm to the public, both in working directly with clients and in attending public meetings, serving as a liaison with other lawyers and firms, and communicating with other institutions such as banks.

Paralegals are a relatively new occupational group, and as in many such groups, educational requirements vary. Some employers require, or at least prefer, graduation either from college or a paralegal training program accredited by the American Bar Association, or both. Some are willing to hire high school graduates, but where employers have actually done so, the people they hired have had additional qualifications, such as a real estate license or courses in business or office administration.

Employers want paralegal personnel to present themselves well, work independently, communicate efficiently, and, if necessary, be willing and able to work long hours under considerable pressure. Partly because the occupation is new, experienced paralegals with these skills are hard for many employers to find.

In recent years, the job of the paralegal has changed considerably, partly as a result of technology, and partly due to other factors. Much legal research is now done on computers, and facility with automated research and retrieval has become a necessity for the paralegal. On the nontechnological side, the responsibilities of the paralegal have increased considerably. As lawyers have become more accepting of the paralegal's role, the paralegal has acquired more responsibility and independence. Some lawyers now depend so heavily on the assistance of paralegals that, as one employer said, there are times when *"All the attorney has to do is pick up the paperwork and go to court."* Consequently, employers now want paralegals to have computer experience, or at least to be able to *"sit at a terminal and not freeze up."*

Employers see the expansion of the paralegal's duties continuing in the future. First, many employers say that most work that takes place in a law office does not necessarily require a law degree. Second, using paralegals is a way to get this work done at a lower cost. Third, some attorneys are reluctant to hire inexperienced paralegals, but as more paralegals gain experience, as they increasingly undergo formal training, and as attorneys encounter them more frequently, more employers can be expected to hire them. As a result, employers predict a good future for this occupation, and by the year 2000, many believe, paralegals will be handling much of the work now handled by attorneys.

Restaurant and Store Managers

The responsibilities of restaurant and store managers vary with the size of the businesses in which they work. In smaller establishments, the manager must be something of a jack-of-all-trades, in charge of ordering supplies or merchandise; maintaining inventory, quality control, and financial records; hiring, training, scheduling, and supervising personnel; and providing customer service. In larger establishments, a manager may be in charge of a single department, but in either case, the job of a manager is—as one employer summarized it—*"to be on the job early and stay late,"* and to do whatever is needed to keep the operation running smoothly.

Background requirements for managers differ. Many times, managers can begin in a non-managerial position and work their way up, but to do this, they must usually have a high school diploma. In some restaurants, vocational education training at the secondary level is sufficient for an entry level manager. However, in many large restaurants, employers require a four-year degree, sometimes with a major in restaurant management, sometimes augmented by as many as five years of experience. In retail establishments, some employers prefer a business degree, although others have begun to seek a liberal arts background instead, believing that business programs concentrate too narrowly on technical courses and consequently fail to teach managers flexibility and creativity. Regardless of which degree is required, in many large retail firms it is a requirement for entry into the firm's own management training program.

Planning, organizing, problem-solving, and decision-making—often under pressure—are some of the more important skills a good manager needs. Moreover, these skills must often be applied in situations involving human relations, since most managers supervise staffs ranging from sales clerks or waiters to managerial assistants. Managers also deal with customers, usually when there is some dissatisfaction or complaint. Thus employers want managers to be self-confident, friendly, patient, tactful, stable, and able to communicate clearly.

Employers seem to have more difficulty finding good restaurant managers than store managers. For both jobs, interpersonal skills are more important and more difficult to find than technical ones, but in restaurants the pay tends to be low. As a result, applicants are often young, inexperienced, and ill-equipped to deal with the frequent emergencies that restaurant management entails. One employer in Northern Virginia also mentioned Virginia's lack of training programs in restaurant management, a deficiency that may become more important as the trend toward eating outside the home spreads to less urban areas and customer sophistication continues to increase.

Employers agree that computers have made managers' jobs easier by simplifying budgeting, ordering, scheduling, and record-keeping. As a result, even in small establishments and at the lower levels of larger ones, the manager's job is becoming more professional, including greater emphasis on skills in planning, making decisions, and solving problems. At the same time, new technology used by the staff complicates the job, since workers' problems in adjusting to electronic cash registers or new kinds of cooking equipment become personnel problems for the manager. Employers also agree that the emphasis on professionalism, including specialization and interpersonal skills, will increase. They believe that increasing educational requirements can supply these skills, and that in the future, even the manager of a small establishment may be required to have a college degree.

Purchasing Agents

Purchasing agents buy the equipment, materials, supplies, and services that enable their organization to function. In this capacity, they may work for almost any size or kind of organization, from government agencies to hospitals to manufacturing companies. In small establishments they may constitute the entire purchasing staff; in larger ones there may be several agents, each specializing in a particular area—heavy equipment, electronic equipment, and the like. Under this arrangement the people who are directly responsible for these areas may be called buyers or assistant purchasing agents. They usually work under the supervision of a head purchasing agent.

Whatever the arrangement, purchasing agents must have a variety of skills. In order to obtain the goods for the best possible price, they must be thoroughly familiar with both their organization's needs and the range of possible suppliers. They are often responsible for determining whether a particular purchase request should go out on bid or not, deciding which bid should be accepted, and negotiating and administering contracts with suppliers. In addition, purchasing agents must be acquainted with company policy as well as with governmental rules and regulations that pertain to the purchasing process. Finally, they often approve or disapprove requests from departments within the organization, and in case of special requests or unsatisfactory services, mediate between the department and the supplier.

It is not surprising, then, that many organizations, particularly larger ones, want prospective purchasing agents to have had prior experience, and that considerable in-house training is frequently involved. Required experience can range from none to five years, with educational requirements similarly ranging up to a four-year degree in a business field. Nor is it surprising that some employers find it hard to locate good candidates for the job.

Some of these difficulties come from the mix of interpersonal skills employers are looking for in purchasing agents. Among the skills they mention are the ability to mediate; to be tactful, outgoing, self-assured, and assertive; to have well-developed oral and written communication skills; and to work comfortably and easily with a variety of people both in and outside the organization.

Purchasing agents' jobs have been changing in a number of ways. Electronic technology, for example, has affected this occupation from two directions at once. Inside the organization, the use of the computer as an all-purpose financial, record-keeping, information-storing, and word-processing device has reduced the amount of detailed paperwork associated with the job. Outside the organization, any technological change occurring in the goods the organization buys means that the purchasing agent must learn about this technology.

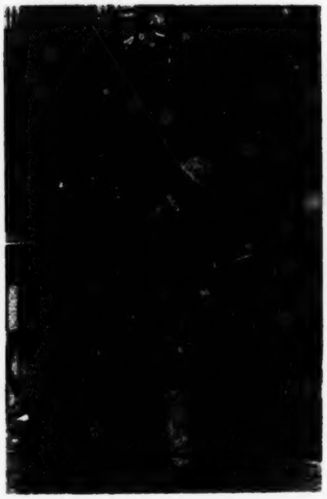
Some employers also mentioned that their firms' use of consultants has resulted in purchasing agents being responsible for contracting for these services. This is a relatively new responsibility and requires the agent to evaluate the potential quality of services that may be provided on a highly specialized and technical basis. Further, as the number and kind of government regulations increase, and as they change more rapidly, purchasing agents must keep abreast of current developments in this area as well.

The effects of these changes on purchasing agents still await assessment. Computerized data storage, retrieval, and record-keeping increase efficiency, but rapid technological change requires the agent to spend more time researching new products and markets. In large companies, the possibility of using computer networking and electronic communications to centralize purchasing may reduce the number of purchasing agents required. In companies that do not now require four-year degrees, there seems to be some movement toward increasing educational requirements. In the long run, the situation will probably vary with the industry, but it seems likely that in most larger establishments both the qualitative aspects of the job—knowledge, judgment, and interpersonal relations—and the technical ones—keeping abreast of new products and processes—will probably become more complex.

Construction Inspectors

Construction inspectors work at all levels of government to ensure that construction projects are in compliance with official codes. The list of specific tasks they may perform is a long one, and includes performing tests to ensure that the ground will adequately bear the load of construction, testing the materials used, checking production facilities at the plants that produce construction materials, and inspecting the final job. Construction inspectors also point out problems to construction superintendents and, if the problems are not corrected, may initiate legal proceedings against the company performing the work.

The State of Virginia certifies construction inspectors upon completion of a three-day course and passage of an examination. Beyond this certification, employers usually do not have a minimum educational requirement for construction inspectors. However, most prefer some experience, either in this occupation or in the construction trade. Others hire inexperienced people on a probationary basis or as trainees.



Construction inspectors need to be thoroughly familiar with the codes they enforce. They must also be able to read and interpret plans and drawings, and to prepare and explain technical reports. Employers emphasize that a construction inspector, as a person who is responsible for enforcing codes, must communicate problems and be fair but firm in dealing with contractors and construction supervisors. Sometimes employers have difficulty finding people with this combination of technical skill and personality. However, in the last few years there have been fewer problems in this area. Because less work is being done on the interstate highway system, the Virginia Department of Highways and Transportation employs fewer construction inspectors than it did formerly, and this has increased the supply of experienced inspectors available to work at the local level.

Two kinds of technological change have affected the construction inspector's job in the past ten years. First, the kinds of building materials used have changed and continue to do so. This means that inspectors must keep themselves informed about new materials and equipment. Inspectors may attend classes, read published research on new technologies, and/or travel to conventions where these materials are displayed and discussed. Second, there have been changes in the gauges, devices, and tests that the inspector uses. For example, the introduction of the nuclear compaction gauge, which measures the amount of soil compression that will occur under a given amount of weight, was accompanied by two days of training in how to use it, and because the gauge employs radioactive materials, the inspector must attend school for a day every four years for safety training.

Another change has also affected the construction inspector's job. Environmental concerns such as erosion control have become more important during recent years. As a result, the inspector must now ensure that any negative environmental impacts of construction are prevented or controlled.

Although these changes have apparently caused few problems, employers of construction inspectors expect technological change to continue and eventually to affect the educational level that will be required for the job. Increasingly sophisticated testing equipment and even more rapidly changing construction technology may lead either to a requirement for some engineering courses, or to expanded requirements both for initial certification and for ongoing training. However, employers agree that the basic nature of the job will not be altered by such changes. The tools may change, but the construction inspector will still be in charge of ensuring that building projects conform to governmental codes.

Insurance Agents

Technically, an insurance agent is employed by a particular insurance company, while an insurance broker is self-employed, selling and servicing policies issued by different companies. However, the basic tasks of an agent and a broker are the same. Both help a customer determine the policy needed for a particular situation and sell the customer that policy. Depending on the company for which the agent works and/or the agent's or broker's area of specialization, this customer may be an individual or a firm. Both agents and brokers also provide other services, collecting payments, making changes to policies, and increasingly becoming involved in customers' general financial planning, particularly on the individual level. In connection with this involvement, some agents also sell mutual funds and other securities, and/or offer formal financial planning services. They provide these services mainly in connection with policies they themselves have sold, thus becoming a customer's "own" agent in much the same way that accountants and lawyers become their clients "own" members of those professions.

The State licenses all insurance agents, awarding a certificate after 45 hours of classroom attendance and passage of an examination. Various national organizations, such as the Life Underwriter Training Council and the National Association of Health Underwriters also offer courses and certificates for their completion, some lasting as long as two years. Agents who sell securities or wish to become chartered financial analysts need additional courses, certificates, and licenses. Finally, in some companies job candidates must pass the firm's own tests for verbal and mathematical skills.

Employers do not usually require a prospective agent to have a college degree, but they do prefer it, particularly a degree with a business major. Some also prefer experience, though not always in the insurance field. Requirements for experience range from none at all to some experience in a related field—sales, in particular—to three to five years of experience in insurance. New agents usually take extensive on-the-job training in the company's methods and policies and must follow this up with additional training two or three times a year to familiarize themselves with new regulations, policies, and procedures.

Employers of insurance agents generally seek people who are ambitious and self-motivated. They should have a professional attitude toward their work; for example, one employer was critical of any agent who would recommend an unsuitable policy to a customer merely in order to make a sale. Because business contacts are important to an agent, participation in the local community is also valued. Most of all, however, an agent must be personable and able to communicate with all kinds of people, both in person and over the telephone. In fact, one employer considered the ability to communicate well over the telephone the most important skill of all.

Some employers find it difficult to locate potentially successful insurance agents. To begin with, the personal characteristics of ambition and self-motivation are difficult to assess, as are the interpersonal skills that enable the agent to communicate with a variety of potential customers. In addition, some employers find that many applicants for the job have had unsuccessful career patterns, and the experience of these employers has been that people who have discontinuous work histories often do not perform well as agents. Other employers, however, have had no problems finding good candidates. *"The people are there,"* one employer said. *"It's my job to attract them to our firm."*

Both technological and non-technological change have affected the insurance agent's job. Some companies already have company-wide computer systems; in others they are imminent. Agents use these systems to compute rates, update policy holders' files, retrieve information about policies, and do general record-keeping and word processing. The advent of computerization has met with resistance in many but not all firms. One such firm actually hired a retired agent who had acquired computer expertise to provide the agents with instruction and help in operating the software.

However, most employers believe that these problems with computers are temporary. Although they say they will probably be looking for slightly higher levels of education in the future, this is mainly the result of a combination of other factors. Employers see the work force as a whole becoming more educated and feel that their agents will therefore require a better educational background in order to communicate with customers. Customers, they say, are already becoming more sophisticated consumers, and agents must be able to answer their questions and deal thoroughly and tactfully with their complaints. In addition, the expansion of the insurance business into new markets and new fields such as financial planning will increase the insurance agent's need for a broader education.

Switchboard Operators

Switchboard operators work for telephone companies, hospitals, and other organizations with large telephone networks. In telephone companies, they answer customer signals, provide information, and process calls. In hospitals, they operate the in-house paging and patient call systems as well as incoming and outgoing calls. They may also be responsible for diagnosing and solving routine problems with the system, and for maintaining records such as patient lists, lists of doctors on call, and statistical data relating to system usage.

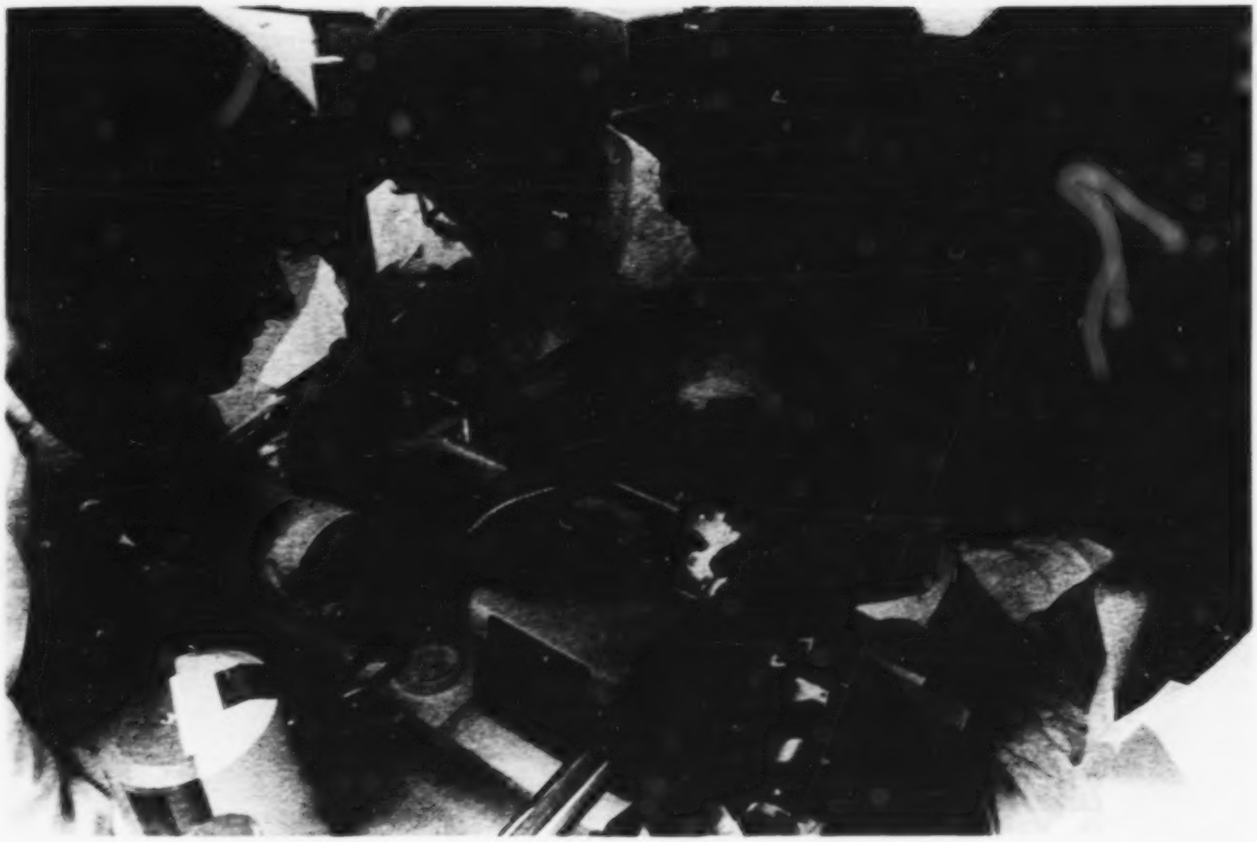
All employers prefer that their operators have a high school diploma, though some will accept people who have completed the tenth grade. All, however, stress the importance of on-the-job training as even more important than either education or previous experience. In fact, some employers would rather train a switchboard operator from scratch than hire one with previous experience, feeling that expertise with another system only makes adjustment more difficult. Such training is, in any case, a matter of only a few weeks. The switchboard operator represents the organization to the outside world, and in hospitals, represents the institution to the patient as well. Therefore, in addition to being reliable—*"someone who is going to be here every day"*—employers want an operator to be personable, friendly, and helpful, and to be able to use the voice to convey these characteristics. In addition, since a switchboard can be a hectic station at which to work, they emphasize that switchboard operators must be people who are not easily flustered and who can deal with stress.

In firms where applicants are obtained through the Virginia Employment Commission, or where switchboard operators have often been promoted from within, employers say that they have no difficulty finding good candidates for the job. However, there can be problems in finding people who can handle the stress of the job without becoming unduly flustered.

Some switchboard operators have had problems in adjusting to the new telephone technologies. The degree to which problems are present is uneven, ranging from simply having to deal with some records on microfilm to almost total conversion to computerized consoles. Where it exists, however, resistance has largely been overcome, partly because switchboard operators have no choice in the matter and are required to use the equipment supplied by their employers.

In addition to new technology, major employers of switchboard operators—hospitals and telephone companies—are facing competition from other firms, some for the first time. Consequently, there is increased emphasis on the operator as the representative of the employer. In addition, employers are increasingly looking for people who find it easy to learn new equipment. The combination of these two factors results in the prospect of slightly higher educational levels. Required levels will probably not be above high school, but some familiarity with computer terminals and video display screens will be preferred, if not required.

On the other hand, some employers expect the number of switchboard jobs to decrease. Sometimes this decrease is projected to be quite radical, with automation taking over virtually all of the functions now performed by operators. Sometimes it is expected to be less extreme, with fewer operators employed to provide a personal touch against a background of automation.



Trends and Skills

Based on the interviews summarized in Part II, this section of our report presents our conclusions about trends in Virginia's work place, the changing job skills required by these trends, and the character traits and values that employers would like to see in their employees.

Trends in the Work Place

Our conversations with employers led us to identify six major trends in the work place:

1. Required skills are becoming more technical;
2. Computers are an important tool throughout the occupational spectrum;
3. Occupations are becoming more specialized;
4. Teamwork is becoming more important;
5. Employers are becoming more client and customer-oriented;
6. The pace of change is rapid.

Several of these trends are interrelated, but in this section we will examine each of them separately and briefly. In the following section, we will describe what employers say and what we have concluded about the relationship between these trends and changing job skills.

The Spread of Technology

Employers say that occupations are becoming "more technical," but what this means is easier to grasp intuitively than it is to describe. In this study, we have defined technology as the tools involved in any occupation, regardless of the nature of these tools. The spread of technology does not mean more tools than before, but that the nature of the tools has changed.

When employers say that more technical skills are required, they generally mean that the skills have less to do with mechanical manipulation than before and more to do with using or repairing electronic equipment. In this sense, file clerks who change from storing and retrieving data manually to doing these tasks electronically are regarded as needing more technical skills than before. Refrigeration mechanics who are installing and repairing equipment that increasingly includes electronic components also, in this sense, need more technical skills.

In many cases, new electronic technology is more difficult to understand than technology based on mechanics, if only because the user, installer, or repairer cannot directly see how it works. Understanding, even in a general way, how an electronic data base system works requires different skills than understanding how to alphabetize documents. The mechanic who can understand how mechanical systems in an automobile work by looking at them and watching them function cannot understand electronic systems in the same way.

Thus, the introduction of electronic technology has introduced the abstract into many jobs that formerly dealt almost exclusively with the concrete. Instead of being able to touch and move the components of the technology directly, people who use it now must base their understanding of how things work on information furnished them by others. They can no longer see for themselves, but must deal with electronic processes that are literally invisible to the naked eye. In this sense, the meaning of "technical" approaches "abstract." Understanding the new technology means understanding what cannot be directly contacted.

Computerization

The computer is the best known and most visible manifestation of the new technology. It is now found throughout the work place in a number of forms, including word processors, microcomputers, terminals, and mainframes. Since the computer is one form of electronic technology, what we have said about this technology in general is also applicable to the computer. However, so many employers mentioned computers specifically, that it is worth examining computerization as a separate trend.

The invention of the microcomputer has affected jobs in two major ways. First, it has given rise to new industries and businesses that manufacture not only the computer equipment itself but also a variety of peripheral devices—the drives in which discs are used, printers, and plotters, to name just a few. Other companies write programs for the machines, ranging from programs that allow drafters and engineers to model new designs to those that help the farmer track feed consumption and predict profits. Some companies manufacture supplies—diskettes, special paper, printer ribbons, and specialized furniture, and still others sell the equipment and materials, and usually provide repair services. These industries and businesses employ increasing numbers of people, many of whom are required to have special skills.

The second way in which the computer has affected jobs is by increasing the number of people who are required to use it. Some fields are more affected than others; office workers, for example, must use some form of electronic technology—a word processor, data base manager, or computerized switchboard—daily. Protective service occupations—police, guards and doorkeepers, and corrections officers—and some occupations providing direct personal care, such as psychiatric aides and child care workers, are probably the least affected. However, jobs that require workers to know how to operate a microcomputer are growing, and both the number of people using computers at work and the ways in which computers are used are likely to keep increasing.

Specialization

Specialization in the work force increases as technology proliferates. When all automobiles were Model T Fords, employers did not need mechanics who could also repair Chryslers. Before electronics became widespread, today's numerous subspecialties within electronic engineering did not exist. With the spread of computerization, employers are looking for programmers who not only specialize in a general way—for example, in business or scientific applications—but also know something about the field—geology, for example—in which they are working.

In some cases, occupations are simultaneously experiencing both pressures toward and away from specialization. Some insurance companies respond to competition by requiring each agent to become acquainted with the entire range of the firm's services, both old and new, while others prefer agents who specialize. The same is true of accounting firms. But the more general movement is in the direction of specialization, and the needs it engenders can be a problem for employers. Educational institutions seldom have the funds to acquire the variety of equipment used in the field, nor can programs accommodate such diverse training requirements. In rapidly changing areas where new specialties arise frequently, teacher shortages are common. Newly-trained people can earn far more as practitioners than as teachers, and experienced educators often lack the time and resources to keep up with the latest developments in their fields. Thus, many employers must shoulder the burden of extensive on-the-job training for workers who are entering the labor force as well as for older employees.

Working in Teams

In many occupations, employers are increasingly organizing employees into teams. References to "the health care team" are common, but employers are also organizing workers in this way in engineering, automobile repair, and computer programming. The trend toward working in teams is related to the trend toward specialization. In some automobile repair shops, for example, mechanics specialize not only in one make of car, but in repairing a particular part, and a complete overhaul therefore requires the participation of several people. Frequently, teamwork is also important where on-the-job training is extensive, with teams consisting of senior, intermediate, and beginning workers who combine their efforts both to facilitate training and to get the job done.

Customer-Client Orientation

As business experiences increasing competition, employers' awareness of the importance of public contact is also increasing. Employers realize that customer or client satisfaction is vital to their survival and that pleasant, helpful service contributes to attracting and holding business.

This trend is taking place everywhere but particularly in areas such as banking and health care where competition has recently increased. As more vendors employ their own repair people, employees in this area too have more direct customer contact than before. As a result, employers in many areas told us how important it was that their employees do a good job representing the firm or establishment to the public.

The Pace of Change

We have listed five trends that are affecting jobs in several different areas. Some of the trends—computerization, for example—are relatively new; some, like the need for teamwork, are new only in the sense that they are expanding into occupations where they have not been important before. The last trend we identified was the increasing rapidity of change and the tendency for several interrelated changes to occur at once.

Much has been written about the current trend for rapid change and the difficulties of keeping up with such change. Employers certainly feel these pressures and pass them on to their employees in the form of new skill requirements. The content and technology of many occupations is changing rapidly, sometimes so rapidly that training cannot keep pace. However, we would like to introduce a caution. Our discussions with employers indicated that the effects of change vary by occupation. In some occupations—for example, nursing, systems analysis, and engineering technology—rapid technological change has been a part of the job for some time. People in these jobs must either have or develop the ability to accommodate to rapid change, or they leave the occupation. In other situations, considerable change has recently taken place, but barring the appearance of another new technology, employers do not see much more change occurring. In still other occupations, technological change has had little impact, and in some, no real change has taken place at all.

We have done this study at what might turn out to be an unusual point in time, a time of exceptional technological change. Occupations that have recently completed adjusting or are still in transition feel the impact of this change strongly, but the future of change in these occupations may not continue to be as rapid. Moreover, the degree to which change has caused problems varies. Electronic cash registers, for example, are a new kind of equipment, but the people who operate them were not included in this study because employers indicated that learning to use them was quick and easy for almost everyone. We need, therefore, to be cautious when we talk about rapid change. The degree to which it has affected occupations varies, and the degree to which it will continue remains unknown.

Skills in the Work Place

Each of the trends we identified contributes to the need for skills in one or more areas:

1. Basic skills;
2. Interpersonal skills;
3. Computer skills;
4. Reasoning and generalizing skills.

The Basic Skills

One set of skills—reading, writing, and arithmetic—is usually considered basic to all others. In view of what employers have told us, we would have to change this list slightly. The three R's now include an S, for speaking.

Our discussions with employers have made it clear that reading skills are becoming more important to many occupations. As technology changes, workers must be able to read and understand manuals and other materials that are both complicated and technical, and reading is a skill which is now as important for automobile mechanics and machinists as it has always been for engineers and teachers.

Employers seem satisfied with workers' skills in this area, but several expressed some concern about the future. Predictably, this concern is concentrated in those occupations that require the least education, but whether it is warranted remains to be seen. Since few employers complained about their current employees' reading ability, and since many of the occupations we studied have already been affected by changing technology, we wonder whether additional skills will be needed. Nonetheless, it should be recognized that reading and understanding increasingly complex technical materials is now a required skill across the occupational spectrum, and even if the importance of these skills does not increase in the future, it will certainly not decrease.

Similarly, we received little indication that employers have serious problems with basic mathematics. Perhaps a few more employers indicated deficiencies in this area than in reading, but the proportion was still small. Part of the explanation may be that where these skills are important to the job, they are taught as part of the training program, and those incapable of learning them do not complete training successfully. However, even where there is no specific training for occupations that involve manipulating numbers—as in the case of payroll clerks—employers indicate no dissatisfaction with job applicants' mathematical skills. Only a few even expressed concerns about their levels in the future.

On the other hand, in the areas of both written and oral communication, many of the employers we talked to found problems existing throughout the occupational spectrum. Writing skills are not important in every occupation we examined, but they do affect nearly all clerical and professional occupations—even those such as accounting and engineering in which basic skills may be mathematical rather than verbal—as well as a considerable proportion of technical, sales, and service occupations. Problems with writing are of two types. First, employers cite deficiencies in spelling and grammar, which affect not only people who do the writing but also those like typists and secretaries, who are often expected to catch errors in the work of others. Second, employers find that where writing is an important skill, clarity of expression is frequently a problem. At higher occupational levels, people need to know not only how to spell correctly and use good grammar, but also how to communicate effectively and unambiguously. Apparently they are not always able to do this.

Some of the same problems that employers find in writing—bad grammar and unclear or inaccurate expression—are also problems in speaking. Poor speaking skills, however, do not seem to be confined to any specific occupation or group of occupations but were found throughout the occupations we studied. Moreover, several secondary skills depend on the basic skill of being able to communicate well orally.

First, in a work force that is increasingly organized in teams, team members must be able to make themselves understood to their fellow workers. Even where teams do not formally exist, the need to express oneself clearly is present every time a supervisor issues instructions to another employee; if communication is unclear or otherwise flawed, the ability to get the work done is hampered.

Second, employers' increased concerns with customer/client and public relations translate directly into the desire for employees to present themselves in a manner that reflects well on the organization they represent. They must be able to speak well, with good grammar and diction, and must be able to convey their meaning clearly whether they are speaking to a distraught customer, a representative of a government agency, or a supplier's salesperson.

Finally, the trend toward adding a sales function to occupations that have not previously included this function also increases the need for writing skills and speaking skills. Examples of this change are the bank teller who is now responsible for acquainting the customer with the range of services that the bank offers and the civil engineer employed by a consulting firm who must give extensive oral presentations as part of the bidding process for contracts. Although the engineer may need oral skills that are more difficult and complex than those needed by the bank teller, both must present themselves as intelligent, competent, and well-informed. In both cases, or when an office machine repairer discusses the advisability of upgrading equipment, or a vocational education teacher tries to place a handicapped client, selling is an important part of the occupation, and good oral communication is an important part of selling.

In summary, employers seem to find reading skills generally adequate, but they believe this might not be the case in the future. Most are also satisfied with the level of mathematical skills found in the labor force. On the other hand, employers are not satisfied with their employees' ability to communicate, either in speaking or writing. Employers consider the quality of workers' contacts with people outside the organization to be very important and tend to be dissatisfied with employees' skills in these areas.

Interpersonal Skills

With the team approach to work and the emphasis on customer, client, and public relations comes the need for workers to have interpersonal skills. Almost all employers mentioned these skills in one way or another, and many consider them the most important of all.

Employers want workers to have three kinds of interpersonal skills. First, anyone who works with others and/or deals with the public—and most workers do one or both—must be personally presentable. *"Good personal hygiene"* is the phrase many employers use to refer to cleanliness, good grooming, and appropriate dress. Even when the job may not require the person to remain neat and clean throughout the day, demonstrating presentability at a job interview is an almost universal requirement.

The second interpersonal skill, which has always been an important one, is getting along with co-workers. Employers often mention *"the ability to take directions,"* or *"the ability to tell others what to do and not go off on a 'power trip'"* in this context. However, getting along with colleagues and co-workers has gained even more importance because employers are organizing their employees into teams that contain people from several related occupations who work together to achieve a goal. The engineering team, for example, may contain one or more engineers, technicians, and drafters, all working on one design. Nor do these teams exist only in professional and technical occupations; they are found in other occupations as well, particularly those with extensive formal or informal on-the-job training, in which the trainee works under the supervision of one or more experienced workers.

In all of these settings, the employee who cannot communicate with others, or who causes an undue amount of conflict, is undesirable, not only because such a person is unpleasant, but more importantly, poor communication and conflict interfere with the primary aim of getting the work done, and thus represent a cost to the employer. Consequently, it takes unusual expertise on the job to overcome the handicap of poor interpersonal skills, if, indeed, it can be done at all. *"We don't hire the long-haired types anymore,"* said one employer. *"A lot [of them] do good work, but they don't get along and no one can understand what they're talking about anyway . . . So if you can't stand being around them and you can't communicate with them about what you want, what good are they?"*

The third interpersonal skill, which cannot be overemphasized, is the ability to represent the employer favorably to clients, customers, and members of the public; it includes personal presentability—good hygiene, proper dress, and the like; the ability to communicate clearly; and a pleasant manner. The majority of the occupations included in this study require public contact, and in most of these cases employers mentioned getting along with the public as a required skill. These occupations range from the professional to the relatively unskilled, from engineers, nurses, and teachers to repair people and privately-employed guards.

Moreover, having these skills is of benefit to the employee as well as the employer. Particularly in production and repair work, employers often mentioned the importance of "a stable work history" as a job requirement; those who have a history of bad work habits fail to fulfill the fundamental requirement for being hired. Employers also say that the applicant who comes properly dressed to an interview, who is polite and speaks well, will be hired above the one who comes sloppily dressed, is rude, and speaks poorly, even if the latter has an edge in terms of technical skill. Finally, interpersonal skills are also involved in getting ahead on the job. The automobile mechanic's helper who works well under the team leader's supervision, gets along with the other team members, and is courteous and well-liked by customers will be promoted faster than the person who does not behave this way.

Sometimes, employers left us with the impression that they considered interpersonal skills to be matters of individual personality rather than skills that can be taught. In some cases, this is undoubtedly true, in others, not. A person who has been raised in an environment that does not stress interpersonal skills might be unaware of either their nature or necessity but quite able to learn them. Training programs for the disadvantaged often include units that attempt to teach some of these skills. Sometimes, too, employers seemed to believe that a college education imparts interpersonal skills and that raising required educational levels for an occupation might be a solution, even where technical skills do not require a four-year degree. However, for employer and employee alike, such educational inflation is a less efficient remedy for lack of interpersonal skills than teaching them earlier in the curriculum.

Computer Skills

As a result of computerization, increasing numbers of employees in many occupations need to be computer literate. These workers are divided into two groups: first, specialists who work in computer-related occupations; second, employees who use computers in jobs in other fields.

Computer specialists, the first of the two, are an occupational group that is growing rapidly, but in Virginia, as in the rest of the nation, they still constitute a small proportion of the total work force. Depending on their specific occupation, computer specialists require training that ranges from postsecondary vocational education courses through advanced degrees. They must not only be able to adapt readily to changing technology but in many cases originate the change. For these people, computer literacy is just the beginning, the base on which their technical and professional skills are built.

The second group, those who use machines that are designed, repaired, and programmed by the specialists, are more numerous in the work force. These employees are computer users, who often come into contact with computers in one form or another on a daily basis. If computers in the work place are to be used with maximum effectiveness and efficiency by this broad and rapidly growing group, computer literacy should be as basic to their education as reading, writing, arithmetic, and speaking.

A major problem, of course, is defining computer literacy. The question is how much a worker needs to know about computers to be able to use them effectively. At this point the difference between computers and other tools becomes important.

The most important characteristic that differentiates computers from traditional tools is their scope. A computer, even a small, limited one designed to do nothing but word processing, can do more tasks than most traditional tools. Traditional tools tend to be single-purpose; computers are multipurpose. Robots, for example, can replace certain workers because the computer elements they contain can be programmed to perform a variety of functions, but office machines probably constitute the simplest and most widely-encountered example of why this multipurpose tool is having such an enormous impact in the work place.

As an example of how computers have revolutionized office work, suppose that a secretary in a traditional one-person office is asked to carry out a straightforward task. It consists of selecting customers who are a month in arrears of paying their bills, sending them each an identical letter requesting payment, producing a new copy of the bill to enclose with the letter, duplicating letter and bill, filing them, and mailing the originals to the customers. In this office, the secretary goes first to the files, selects the proper folders, totals the outstanding charges, and types a letter and bill for each customer, proofing each for errors. The body of each letter is identical, but the names and addresses vary. The bills are all in the same form, but the contents differ. When this task is completed, each letter and bill is duplicated on a copying machine, and the duplicates are inserted into the proper file folders, which are then returned to their original places in the file cabinet. The secretary then addresses an envelope to each customer, inserts the letter and bill, affixes postage, and mails the result.

With the help of a computer, the task can be done far more accurately and efficiently. The secretary uses a program that performs several functions at once. Having inserted the proper diskettes into the computer, or requested that the proper files be called into operation, the secretary enters the criterion on which customer records are to be selected and tells the computer what functions to perform with these records. In this case, the computer will select all the customers whose records indicate that they are a month in arrears. For each of these it will calculate the sum of outstanding charges, call the appropriate letter from a storage file, insert names and addresses into the letter, call the billing form, insert the proper information onto the form, and print out the letters and bills along with a mailing label. The computer will also automatically add information about what it has done to each customer's record. The tasks that have been eliminated are pulling files, using an adding machine to calculate outstanding charges, typing and proofing letters and bills, using a duplicating machine, and filing the new information. All that remains is stuffing the envelopes and sticking on the mailing labels and postage.

This example demonstrates three important characteristics of computers. First, computers are multipurpose machines, capable not only of doing many different tasks but also of integrating them. In this example, retrieving information, doing calculations, altering text, filling out a form, printing, updating records, and storing information were combined into a single operation.

Second, computers can not only do many different tasks, they can do them in many different ways, singly or in combination, efficiently or inefficiently, depending on how they are programmed and how the programs are used. The secretary in our example could have used the computer inefficiently by making it do the entire sequence of tasks one step at a time. For example, first ask the computer to find the customers who are in arrears and list them. Then enter each of these names, asking the computer to calculate the amount each owes, and so forth. This step-by-step method of carrying out the task parallels the traditional way of doing things, and is often the way in which untrained people use computerized equipment.

Third, this capacity to do many tasks and to combine them in different ways means that in order to use the computer creatively and efficiently, the user needs to know something about how it works. This knowledge, in turn, allows the user to ask intelligent questions about what the equipment can do and to use this information as the basis for informed decision-making. This need for knowledge applies as much to the typist, who can save hours of time by using word processing equipment efficiently, as it does to the purchasing agent who makes a million-dollar decision about what equipment a company will acquire.

The employers we spoke with in the course of this study left no doubt that they want the people who work for them to use computers creatively. Often employers themselves did not know much about computers, and as a result, they were not always specific in what they told us, using terms such as *"familiar with computers,"* or *"computer literate,"* or *"knowing what to do"* with them, but their intent was to indicate a need for people who are acquainted with what computers are, what they can do, and how their logic functions.

However, among employers, workers, and educators alike there is a common view that the computer is an arcane machine, and that ordinary people who were not born *"thinking like computers"* are somehow incapable of learning about them. We do not believe this to be the case. While not everyone may have the capacity to be a professional computer programmer—as not everyone has the capacity to be an electrician or a nursing attendant—the majority are able to learn as much as or more than they need to know in order to be intelligent users. To do so, they need the ability to reason and generalize, and therefore we will discuss these skills next. They are required not only by computerization, but by other trends as well.

Reasoning and Generalizing Skills

The spread of technology and computerization, increased specialization, the need for interpersonal skills, and the rapidity of change are trends in the work place that create new demands for skills in reasoning and generalizing.

As we described earlier, technology and computerization have introduced abstraction into many jobs in which employees must design, use, and repair electronic equipment. People who use mechanical equipment can literally see it functioning, but the inside workings of electronic equipment are not so accessible. An automobile mechanic can see a broken fan belt, but when a computer malfunctions, the user cannot look inside and see what part is broken because a logic board that is not working looks the same as one that is. Consequently, when a computer does not function properly, the user may not know if the cause is operator error or a machine problem. Mistaking the cause of error can in turn result in significant loss of time spent waiting while a repairer tries to diagnose and fix the nonexistent problem.

In order to diagnose the source of the problem in this case—to know whether to call the repairer or not—the user must understand how information moves from the keyboard to the screen, memory, and recording device. Since these processes are invisible, the user must understand them in the abstract, using reading materials, diagrams, other peoples' explanations, or all three. Thus, in order to learn how to operate electronic equipment efficiently, the student must work with a model rather than with the machine itself and use reasoning and generalization to generalize from the abstract to the concrete.

For different reasons, increasing specialization and rapidity of change require new skills in reasoning and generalizing. Most employers realize that the educational system cannot train people to operate and repair each kind of equipment they might encounter on the job. Furthermore, change is occurring so rapidly that even highly specialized training becomes quickly outdated. Employees who can see how an unfamiliar tool, machine, or process is similar to a familiar one can use this ability to facilitate learning and can more easily accommodate to rapid change. And because change is so rapid, in many work environments—the welding shop as well as the automated office—employers increasingly look toward workers to be technological experts who can suggest and implement ways of using new equipment.

Reasoning and generalizing are also basic to understanding others, helping workers acquire the interpersonal skills increasingly required by employers. People who can generalize from the way they feel to the way others feel usually have better interpersonal skills than those who cannot. They make better team members and deal more easily and competently with clients, customers, and the public. In short, the ability to reason and generalize is basic. As one employer said, *"Give me a person who can think, and I'll train them to do anything they have to do."*

Character and Values in the Work Place

In addition to asking employers about the training, experience, and technical skills they required of their employees, we asked what other characteristics they found desirable and whether they had problems finding job candidates with these traits. In response, many employers gave us long lists of character-related traits that varied in two ways: by occupational level and content.

First, when they talked about occupations requiring the least formal education—usually a high school diploma or less—employers often mentioned the combination of traits associated with the traditional work ethic, including dependability, honesty, and a positive, cooperative attitude. Frequently employers considered these traits just as important, and sometimes more important, than technical skills. However, as we moved up the scale to occupations that called for increasing educational levels, the frequency with which employers listed these traits decreased. We doubt this is because they become less important; rather, employers seem to assume that applicants for these jobs already have these values, and in many cases this is probably true. Where training is lengthy and specific to an occupational goal, those who lack sufficient commitment or behave unacceptably fail to complete training, either by their own or the instructor's choice.

Second, desired traits and values vary by occupational content. A number of jobs, particularly those that center on dealing with people, require special character traits. Employers want people who work in health care and teaching to have a combination of traits that includes compassion, objectivity, maturity, and self-awareness. Intuitiveness and sensitivity are related traits that were mentioned in regard to some clerical workers, particularly secretaries and receptionists. Protective workers and psychiatric aides, who often work with people under stressful and sometimes violent conditions, need not only sensitivity and compassion but also level-headedness and emotional stability. Still other special situations call for different traits: integrity when a worker handles confidential materials; assertiveness when the job involves selling or supervision; dedication when the job entails long hours and/or low pay.

Ambition was another trait often mentioned, but even though it is a characteristic that tends to be highly valued in our society, its desirability varied among employers. Where an employer considers a job as the bottom rung on a career ladder, ambition is highly desirable and is sometimes encouraged by employer-financed and/or sponsored educational opportunities. However, where employers do not intend to promote from a position, they prefer people who are not interested in advancement, since they believe that these people will stay in the job longer. Furthermore, a job can be classified as career-ladder in one firm and the opposite in another. Computer operator is an example of this kind of variability.

Unlike ambition, adaptability and flexibility are not only often mentioned but universally desired. Several trends in the work place support this requirement. Increasing teamwork and concern with client/customer relations require more employees to deal with people and to be adaptable and flexible in the course of doing so. Changing job skills and the rapid pace of change also require workers to adjust quickly and easily to changes in tools, processes, and tasks.

Despite employers' long lists of desired character traits, most of them said they had few problems finding job applicants who met the requirements. A few felt young people were lacking the work ethic, but in general, most seemed satisfied. Several factors probably account for their satisfaction. First, the occupations we studied are relatively skilled and are not likely to be sought by people lacking the requisite traits. Second, many applicants have been prescreened by training programs. Third, in many of the occupations, the applicant pool is quite large, allowing for considerable selectivity among candidates. Consequently, employers' ability to find candidates who fulfill their requirements does not necessarily mean that all or even most young job applicants have the desired characteristics. It is also true, however, that many young people of the 1980's are more concerned than were the youth of the previous two decades with locating a job and advancing in it; consequently, the values desired by employers are more congruent with the values of labor force entrants than they may have been in the recent past.

Summary

Both the six trends and the four skill areas we have discussed in this section are interrelated. Not only do the trends contribute to and reinforce one another, but so do the skills, and further, each trend produces the need for skills in more than one area. In one sense, the degree to which these skills contribute to and reinforce one another is encouraging. It means that improvements in a single area are likely to be reflected in others. In another sense, this interrelatedness indicates the importance of each area: to the extent that each can be enhanced, the result will be synergistic, yielding a degree of improvement greater than the sum of its parts.

Programs that teach these skills are in place in many settings in Virginia. The challenge is to expand and integrate these programs in order to prepare the Commonwealth's young people for full participation in the labor force. Employers left us with the impression that their expectations are high but not unreasonable, an impression supported by their satisfaction with many of the job applicants they encounter. But they are concerned about the ability of training to keep up in a future in which the pace of change may be even more rapid and its direction even more unpredictable.

PART FOUR

Communicating with Educators

An important part of our study of changing job skills in Virginia looks at communication between employers and educators: the extent to which it has taken place, how satisfactory employers believe it has been, and their suggestions about ways such communication can be enhanced. This section of our report summarizes briefly the formal communication mechanisms already in place, the responses of employers who have not tried to communicate and those who have, their suggestions about ways to enhance communication, and the conclusions we drew from what they told us.

Current Communications Mechanisms

Currently, both the Virginia community college and the public vocational education system have mechanisms in place for gathering information from business and industry to assist with curriculum and planning. The Business/Industry Advisory Council, made up of executives from private industry in Virginia, advises the community college system. In addition, each community college has a General Vocational Education Advisory Committee of local business and industry personnel, and a committee of people knowledgeable in the particular field advises each occupational-technical program. At intervals, community colleges contact local employers for community needs assessment studies, and as this is being written, the Virginia Community College System is undertaking a statewide survey of business and industry to determine the specific skills that their graduates need.

On the secondary level, each school district has a local vocational education advisory council, which includes representatives from business, industry, organized labor, and the general public. Most public school vocational education departments also have groups of advisors on specific occupational programs.

As we shall see, employers vary in their assessment of these mechanisms for communication. Some have found them useful; in fact, some praise them highly. A few have found them to be a source of frustration. A surprising number of employers, however, either do not know about them or do not perceive these mechanisms as accessible.

Communicating

Half of the employers we spoke to had not communicated with educators about their training requirements. One common reason for this was lack of need. Sometimes applicants were pre-screened: the employer filled the job by promotion from within or used an employment agency. However, most of the employers who said that they had no need to communicate with educators were satisfied with the quality of their job applicants and thus with their backgrounds and training.

Other employers rely completely on in-house training and therefore have no reason to communicate. Occasionally, employers do not trust educators to provide proper training. For example, an employer of insurance agents preferred such training because he feared that *"teachers might be biased or give incorrect information."* More often, however, employers believe that only hands-on experience unavailable in an educational setting can provide the requisite training. This is a particular problem for employers of mechanics, repair people, and others who work with specialized machinery, but it also emerges in occupations that require extensive skills in human relations and in professional and technical occupations such as computer programming and engineering, where specialization is a growing trend.

However, some employers who had not communicated with educators either did not feel they had the opportunity or did not believe that communication would accomplish anything. The first group often mentioned needs they would like to discuss, but most of them seemed unaware that letting educators know about these needs was a possibility. *"I never knew the opportunity was available,"* said one of them. *"I've never gone out and called the schools and said 'I want to talk to you about it,' but then, I've never had anybody call me up and say 'what do you need' either."*

The second group had not spoken with educators because they did not believe the educators would respond. They saw educators as members of a bureaucracy that either could not or would not accommodate to their needs and believed that they would not have access to those who make the decisions. One employer summarized this point of view, saying *"No, I know how they work. Their curriculum is set by big committees and I don't even know where they are. And anyway, the big guys won't listen, so . . . it just doesn't seem like something that would be worth my time."*

The other half of the employers we talked with said that they had at some time been in communication with educators. In turn, the majority of these felt that the experience had been positive and the outcome useful. A few of the employers we talked with served on advisory boards or councils, representing a group of people with similar needs in a particular occupational area. These employers generally valued this experience, though they did not always consider it of direct benefit. However, we believe it significant that in most cases where an employer had communicated successfully with educators—whether in a high school, community college, or university setting—the contact had been direct, rather than through a board or committee. Occasionally the contact was accidental—an employer and an educator might have met socially—but in general, two settings for such one-on-one contact emerged.

The first setting in which employers believe they have been able to communicate effectively with educators is informal. A number of employers simply maintain frequent personal contact with educators. One large employer of typists, for example, was dissatisfied with the spelling and grammar skills of clerical applicants, and told the local school system about this. The school system's response—implementing a spelling course in the local high schools—demonstrated its receptivity and earned considerable praise from the employer. Other employers, while not receiving the exact response they might want, are nonetheless appreciative. One employer of electronic assemblers said, *"I've given [the local community college] hints on their curricula, and I've hired some people from there. Even though their program is geared more toward broadcasting than broadcast equipment manufacturing, they are listening."*

The second setting in which personal communication takes place is a formal one: internships and cooperative education programs, in which students work less than full time for the employer while taking classroom training in high school or a community college. Such programs are found in engineering-related technology, health care, clerical work, and skilled crafts, among others. They allow participating employers to affect training directly because the employers have person-to-person contact with both the trainee and the educational institution. These programs also reduce the employer's need for on-the-job training by supplying real-world experience as part of the training program.

A minority of employers who had tried to communicate with educators felt that their efforts had been fruitless. In several of these cases, employers were requesting new programs or major changes in old ones. An employer of office machine repairers had hired a few people from a vocational/technical education program and had tried to talk with educators about *"the sort of background a person needs to work as a technician."* The effort did not, however, *"make a whole lot of difference. The[ir] electronics course deals mainly with TV and radio electronics, which is not helpful for office machine repair."* This employer said that *"the instructor's hands are tied. He can't change what he teaches—it's handed to him from some committee."* Another employer has tried but failed to have programs for training restaurant managers instituted. Still another has been unsuccessful in convincing a university to award credit for internships in accounting.

Sometimes employers' negative perceptions resulted from only one attempt to talk with educators. Sometimes, too, such impressions resulted from a breakdown in communications involving a board or advisory council of which the employer was a member. Finally, a few employers had discussed with educators such problems as their need for training on specialized equipment, and occasionally, even though the employer understood why the school or training program could not respond to this need, the employer evaluated the experience negatively.

Employers' Suggestions

When we asked employers to suggest how employer-educator communication could be improved, many of them had no suggestions to make. A few responded with profound pessimism to the whole idea, suggesting that educators "*live in ivory towers,*" that they "*have big egos and don't like to be told they're doing things wrong,*" and that the educational system is "*archaic, bureaucratic, and politicized.*" Others, particularly the many who had communicated successfully, thought there was no need for change. Most of the employers who had served in an advisory capacity or had informal one-on-one contacts with the local school system felt they had good rapport with local educators and were generally satisfied with the current mechanisms for facilitating communication. In fact, some were so enthusiastic about the responses they had received from educators that they were afraid any change in the current system could only be for the worse.

Most of the suggestions about how employers and educators could communicate more effectively came either from employers who had not tried to communicate before or who had evaluated their efforts as unsuccessful. Some of these employers couched their ideas in general terms: employers should take the initiative, or—more frequently—schools should take the initiative, or there should be seminars or committees set up to bring people together and provide a framework for discussion.

Several employers, however, had specific ideas about how to facilitate communication with educators. Some believed that the best way for educators to respond to their needs was by establishing more cooperative education programs and internships. "*Schools should do more outreach,*" one employer said. "*They should put students out with employers for a couple of months in an internship program, even if it's just to look over the shoulder of the person who's really doing the job. Then, afterwards, the employer could go back to the educators and show them where their students are deficient.*"

Another employer thought that more diversity among members of advisory boards would help. This employer echoed the comments of others who perceive public boards and committees of all sorts as consisting of overlapping memberships of the same community leaders, who do not necessarily represent the smaller employer or "*ordinary guys like me.*" In addition to increasing the scope of representation, this employer also felt that diversity would contribute fresh points of view and new ideas. Still another employer mentioned that some schools set aside a few hours at career day during which employers could talk directly to teachers, suggesting that other schools might adopt this practice.

Some employers considered studies such as this one helpful and said they would like to see them done more often, more regularly, and more widely. Several also thought it would be a good idea for educators to get out of the classroom and visit establishments to see first hand what the jobs for which they were training people involved. *"If they're not already doing that,"* one person said, *"they sure . . . ought to be."* Another person suggested that: *"If the educational system could have a 'pool' of job descriptions from local employers . . . they could better match their programs to suit what's being asked for. If questions . . . came up, they could call the firm and arrange to learn more about what [the firm] is looking for and why."*

Finally, one employer summarized the need for communication from an interesting perspective. This person, an employer of computer programmers, said: *"I think institutions should try going to the private sector first, rather than the student. If they came to me and asked what training needs I had, I could send four or five people over there right now, and I'd pay their tuition for the right class. Instead, they send their graduates to me fully trained, but in the wrong thing for my business. Industry could be a very profitable source of student recruitment."*

Conclusions About Communicating

Putting this all together, we can draw a number of conclusions about employers' needs to communicate, their propensity to do so, and the kinds of communication they find most satisfactory.

To begin with, not all employers believe that they need to communicate with educators. Some large companies occasionally consider it a public duty to become involved with the educational system, regardless of whether they believe that the system can benefit them directly. More often, however, employers see no need for such communication unless they are dissatisfied with the quality of their job applicants. Since many have no dissatisfaction, they see no reason to become involved.

Employers' needs to communicate and their propensity to do so varies more by geographical location than it does by occupation. Where the employer is located affects communication in three ways. First, the nature of the job pool varies by area. For example, due in part to the presence of the University of Virginia, the Charlottesville area contains an exceptionally well-educated labor force that includes recent graduates who want to remain and enter the local labor force. This means that competition for jobs in the area is high, employers have little trouble finding well-qualified applicants, and many may not feel the need to contact educators about training. Second, the responsiveness of the educational system to employers' needs also varies geographically. Some areas of the State have a tradition of good communication between employers and educators. Word of the helpfulness of educators in these areas encourages more employers to communicate. Third, some employers are located close to the supply of particular kinds of workers. For example, the Medical College of Virginia in Richmond trains pharmacists, and hospitals in the area often have their pick of recent graduates.

However, even when employers perceive some lack in job applicants or workers, they usually do not initiate contact with educators unless they perceive that the opportunity exists and the situation can be remedied. It is noteworthy that a number of the employers we talked to were completely unaware of the mechanisms that exist to facilitate communication with educators. In fact, the idea of communicating with educators was foreign to them.

Further, if an employer believes that communicating the need for job skills to local educators will be a waste of time, the effort will not be made. Unfortunately, we did not ask employers who believed this where their impressions came from. Even so, based on comments they made, we can speculate that the impressions come from a number of sources. Many employers, for example, have had no contact with the educational system since their own graduation from high school or college. Without realizing it, they may regard the system from the point of view of a student, and if their own experiences in school were not particularly positive, they may generalize these to all educational systems. Furthermore, employers may not be aware of how different the system may be from the one they experienced years before in some other place.

In addition, the opinion that educators *"live in ivory towers"* and are unfamiliar and disinterested in *"the real world"* is a fairly prevalent one and was openly expressed by some, though not a majority, of employers. People who hold this view consider educators to be distant, unresponsive, and impractical. Therefore, they believe educators are neither interested in their problems nor able to help with them. Finally, in some cases, these beliefs about the educational system probably contain at least a germ of truth, and no doubt some employers' failures to communicate effectively with educators play a role in discouraging others from trying.

Many employers believe that the schools should take the initiative in establishing communications. In their view, the schools exist to serve the community of which employers are a part, and therefore schools should be ready to serve them as well as students. Moreover, one way of serving students is to prepare them for jobs, which is best done with employers' requirements in mind. Although some of the employers who hold educators in low regard might not respond to such initiatives, the number who have sought out contact on their own leads us to believe that if educators initiated contact, more employers would respond than not.

The contact that seems to bring the most satisfaction and produce the highest degree of mutual understanding is person-to-person. Although people who had not had contact with educators sometimes suggested committees, seminars, and the like, most employers who were satisfied had talked directly with educators. Often they had talked to people at more than one level—teachers, department heads, principals—and this communication had been sustained over a period of time. Employers seldom mentioned communicating with any of the local vocational education or community college advisory committees, although when such communication occurred, employers generally found it rewarding. Indeed, some local efforts at organized dialogue, such as the Virginia Peninsula Vocational Training Council, received high praise, as did some individual community colleges.

Employers left us with the impression that in order to establish effective communications, the educational system must prove to them that the effort is worthwhile. Before employers will invest time and effort in communicating, they must believe in the possibility that it will bring results. This does not mean that the educational system must meet all of the employer's needs. In fact, where communications have been established, employers demonstrate considerable understanding of the strictures within which educators often operate. Even if employers and educators do not agree, *"at least they are listening"* is a considerably more favorable point of view than *"educators have big egos and don't like to be told what to do."*

The form that such communication should take is less clear. In most settings, communication seems to work best on a one-to-one basis. More and better information is exchanged informally than formally, and understanding emerges more easily when people can discuss their mutual problems, agreements, and disagreements in privacy. This is not to say that more formal mechanisms are unnecessary for problem-solving. However, even where these structures are effective, employers still find direct communication with school personnel rewarding. For the considerable number of employers who perceive educators as rigid, bureaucratic, distant, and/or unconcerned, the best way to change this perception is probably to meet and talk with an educator who is flexible, accessible, and interested.

PART FIVE

Summary and Recommendations

The purpose of this study of changing job skills in Virginia was first to identify:

- The jobs that will be needed most during the next decade and which of them will involve changing job skills;
- The skills and character traits that employers now require for those jobs and how they expect these to change;
- The training and education employers require for these jobs and how they will change;
- The means that employers have used to communicate their needs to educators and their suggestions for improving these channels of communication;

and second:

- To use the results of dialogue with employers to draw conclusions and make recommendations about training needs and employer-educator communication in the future.

How the Study Was Done

We began the study by using the Occupational Employment Survey projections to select occupations that are projected to employ significant numbers of the Commonwealth's citizens in 1990 and that we had reason to believe involved—or shortly would involve—changing job skills. These occupations cover nine major occupational areas:

- Office work
- Health care
- Teaching
- Specialized clerical work

- Protective services
- Computer-related work
- Repairs
- Engineering-related work
- Production

A tenth miscellaneous group contains eight additional occupations.

The employers we talked with represented both the private and public sectors. They were chosen on the basis of the size of their agencies or establishments and their geographical location. In these establishments, which employed from two to more than a thousand people, we talked with 115 employers who were responsible for hiring and/or supervising workers in our occupations. Using a flexible interview format, we asked a series of questions about:

- The skills, educational backgrounds, and character traits employers preferred in their employees;
- The backgrounds from which these people came;
- Whether skills were changing and, if so, in what way;
- Whether changing skills had caused problems for their operations; and
- What they foresaw for the future of these occupations.

In a separate section, we also asked about communication between employers and educators:

- Whether the people we talked with had tried to communicate their needs to educators;
- If so, whether they felt they had succeeded; and
- If not, why not.

Finally, we solicited employers' suggestions about how the mechanisms for communication between the two might be improved or what new ones might be established.

Limitations of the Study

Before summarizing the study's conclusions and presenting recommendations, we want to list some limitations that users of this study should keep in mind. First, although we read as widely as we could about the occupations we studied and frequently consulted experts in the various fields, our resources did not permit us to become thoroughly acquainted with the technical details of many of the more specialized jobs. Second, resources also limited the number of interviews we could carry out, and our sample was certainly not large enough to permit valid statistical analysis. Third, this study was intended to gather and summarize employers' views. It was not intended to include the perspectives of either educators or employees, although these are clearly as important as those of employers in achieving the goal of preparing Virginia's work force adequately. Fourth, and perhaps most importantly, because the study was limited to occupations we knew to be affected by changing skills, our findings do not necessarily apply to occupations that do not presently involve changing skills. Some of these are projected to employ large numbers of people, and some may involve changing skills in the future.

Findings

Our findings can be summarized in three areas: trends in the work place, related skill requirements, and employer-educator communication.

The general agreement we found among employers encouraged us to identify six trends in Virginia's working world:

- The spread of technology;
- The widespread use of computers;
- Specialization;
- The organization of workers into teams;
- The concentration of employers on customer/client relations;

- The rapid pace of change.

As a result of these trends, employers want their employees to be able to:

- Read, understand, and apply technical materials;
- Express themselves clearly in both speaking and writing;
- Think clearly, logically, and creatively in order to generalize their knowledge as broadly as possible;
- Integrate these skills to enable them to use the computer—a pervasive and complex tool—creatively and efficiently;
- Present themselves as friendly, concerned, and well-informed representatives of their employers.

These skills were important in all the occupations we studied, in those that require a college degree or more as well as those that require a high school diploma or less. They constitute what today's employer considers a basic education for all. Consequently, the first set of our recommendations pertains to these basic skills and their integration.

Employer-Educator Communication

When we asked employers about their efforts to communicate with educators, we received three categories of responses:

- About half the employers we spoke with had never tried talking to educators about training needs, either because they were satisfied with the skills and characteristics of the job applicant pool, because they were unaware of the opportunity to do so, or because they perceived educators as unrealistic and unresponsive.
- Of the employers who had talked to educators, the majority considered the contact a success. Most of these successful contacts had taken place in a direct setting

rather than through committees and advisory boards, or through the mechanism of internship and/or cooperative education programs.

- Of the employers who evaluated their contacts negatively, many of the unsuccessful contacts occurred when employers requested major curriculum changes—instituting whole new programs, for example.

Among the suggestions offered for enhancing communications, the most frequently mentioned were:

- Visits by educators to the work place to learn about jobs as they are actually carried out;
- Expansion of internships and cooperative education programs.

But regardless of whether employers had attempted communication and how they evaluated their attempts, the majority agreed that the schools should take the initiative in communicating and that employers were likely to respond cooperatively to such initiatives.

Recommendations

In keeping with the two-fold nature of the study, our recommendations cover two areas: job skills and the employer-educator dialogue.

Enhancing Skills

First, although employers are generally satisfied with the present level of reading skills among their employees, they have doubts about whether these levels will be adequate in the future. As equipment becomes more complex and change more rapid, workers at all levels will increasingly be required to read, comprehend, and apply technical materials.

- Reading and comprehending technical materials, including charts, diagrams, and instructions, should be taught as a basic skill.

Second, both employers' increasing emphasis on customer/client relations and the trend toward organizing workers into teams mean that employees must be able to listen well and speak clearly and grammatically, yet employers consistently find that employees do not communicate effectively.

- Both writing and speaking should receive increased emphasis throughout the educational process, with emphasis on correctness, clarity, and precision of expression.

Third, in most of the occupations covered in this study, the computer has already become a basic tool. Its use extends beyond mathematical computation into occupations as diverse as welding and pharmacy. It is likely that in the future, the use of computers will spread throughout the work force, that opportunities in computer-related occupations will increase, and that new occupations made possible by the computer will continue to emerge. Employers want workers not only to be able to use the computer, but to be able to do so creatively and efficiently. To meet this requirement, an employee must understand something about this new machine.

- Computer skills should be taught to all students. These should include a basic understanding of the way the machine is constructed, the logic it uses, and as much hands-on experience as possible.

Fourth, the spread of new technology and the rapid pace of change have altered new requirements in many occupations. In a work place where specialization and the pace of change are increasing, workers must be able to generalize their expertise to new situations. Employers want employees to work independently and creatively, to solve problems on their own, and to suggest new ways of doing things. These requirements, together with the increased emphases on reading technical materials, communicating clearly, and using computers efficiently and creatively, depend on workers' abilities to reason clearly.

- Reasoning and logic should be taught—perhaps formally—to all students at all educational levels.

Fifth, the same trends that have increased the importance of communication skills—teamwork and customer/client contacts—have increased the importance of interpersonal skills. Employers stress skills important to both self-presentation—personal hygiene, appropriate clothing, and neatness—and dealing with others—tact, patience, assertiveness, the ability to manage conflict, and sensitivity to what others are thinking and feeling.

- Two kinds of interpersonal skills should be integrated into the educational process. The first of these should cover personal hygiene, grooming, and appropriate dress in work-related situations. The second should include skills required in dealing easily and comfortably with other people. These skills stem from an understanding of how others feel, and include courtesy, consideration, tact, and conflict management.

Finally, in regard to education in all skill areas, we recommend that:

- Basic skills, computer skills, reasoning and logic, and interpersonal skills should be taught throughout the curriculum, including the college level; and

- Where this has not been the case, educators will need to identify mechanisms for remedying deficiencies in these areas.

Enhancing Communications

A number of mechanisms exist to facilitate employer-educator dialogue, but many employers seemed unaware that any such opportunity existed.

- Existing mechanisms for employer-educator dialogue should be more widely publicized.

However, it should also be recognized that most of the successful contacts between employers and educators were made on a person-to-person basis rather than through councils and advisory boards. Part of the reason for this is probably explained by the lack of information about formal mechanisms. Part, however, is also that many people find one-on-one contacts more comfortable. Moreover, the person-to-person situation allows an employer to concentrate on specific rather than general needs, and thus may be considered more productive.

- The importance of informal contacts between employers and educators should be recognized and fostered.

The majority of employers believe that communication should be initiated by educators, and they speak highly of those institutions and individuals that have taken this step.

- Whenever possible, educators should take the initiative in contacting employers, particularly on an informal, person-to-person basis. These contacts should include visits to the work place.

Nonetheless, communication is a two-way street, and although we did not talk with educators in the course of this study, it is our impression that most educators both welcome and are responsive to employer initiatives.

- Employers should feel free to contact educators at all levels to inform them about training requirements and to explore ways in which educators can help fill employers' needs.

One of the most successful means of meeting employers' needs is cooperative education. Employers who have participated in cooperative and internship programs praise them unanimously. Not only do these programs facilitate communication, they also meet the common objection that classroom training is too abstract and impractical, provide students with hands-on experience and a head start in obtaining a job, and provide the employer with a prescreened pool of applicants.

- Wherever possible, internships and cooperative education programs should be part of the educational process.

Further Research

During the course of this study, several areas emerged that would benefit from further research. First, as we stated earlier, the purpose of this study was to collect and summarize *employers'* needs in the area of changing job skills. However, we believe that in order to gain an understanding of the total picture, the viewpoints of workers and educators are also vital. Thus, a need exists for:

- Studies that combine the perspectives of employers, employees, and educators to form a comprehensive picture of the changing work place in Virginia and its effects on the educational system.

Second, this study was able to include only occupations that are projected to offer opportunity to large numbers of people in the near future and involve changing job skills. As a result of these limitations, occupations that may be important because they are on the leading edge of technology or involve high level decision-making were not included. Similarly, at the other end of the spectrum, this study did not include unskilled occupations such as janitorial work that are projected to employ large numbers of people but do not involve changing job skills. In this area, employers' assessments of applicants' preparation for work are probably quite different from the ones we encountered in the present study. Consequently, we believe that further research is needed in four areas:

- New and emerging occupations;
- Occupations that are particularly important to Virginia's long-term social and economic goals;
- Managerial, administrative, and professional occupations;
- Occupations that offer employment to the disadvantaged.

In order to keep up with the pace of occupational change, such studies should be done periodically, perhaps every five years.

Summing Up

In closing, we would like to emphasize that many employers we talked with were satisfied with the quality of the job applicant pool—applicants' educational background, skills, and character. Employers are, however, concerned about the continuing ability of education to keep pace in a future that seems to include ever more rapid change, particularly in the area of new technology. Rapid technological change and increased specialization have already forced many employers to rely heavily on on-the-job training, and they expect to continue doing so. But in order to facilitate this training—and re-training—employers are concerned that today's young Virginians receive the basic education that will equip them to make a positive ongoing contribution in the work place.

Employers today do not expect to hire ready-made employees who can start a job without missing a beat so much as they want good, solid workers who can take advantage of specialized on-the-job training and retraining. In addition to computer skills, it is training in the most basic areas—communicating, relating to others, and reasoning—that employers demand. How these skills are acquired, whether they are traits a person is born with, learns in the home, or should be taught in school, is open to debate. Nonetheless, they are required in the world of work today and in the foreseeable future.

Appendix

Table 1. Occupational Employment Survey Projections for Virginia Occupations with Average Annual Openings of 140 or More

Occupational Title	Projected 1990 Employment	1980-1990 Difference	Average Annual Openings
Janitors, Porters, Cleaners	84011	19008	5001
Secretaries	80715	21628	4749
Sales Clerks	72050	12585	3725
Teachers, Preschool and Elementary (1)	51335	95555	2837
Cashiers	52105	13868	2819
General Clerks, Office	59853	9602	2810
Food Preparation and Service Workers, Fast Food Restaurants	37266	13946	2425
Nurses, Professional (2)	35493	11523	2297
Bookkeepers (3)	44608	7760	2275
Waiters and Waitresses	39687	9282	2036
Teachers, Secondary (1)	43089	7455	1895
Nurses Aides and Orderlies	28281	8995	1787
Typists	34651	5923	1711
Guards and Doorkeepers	18565	4896	1623
Managers, Store (4)	29211	5704	1577
Truck Drivers	41241	5744	1295
Sewers and Stitchers (*)	30856	2573	1245
Kitchen Helpers	21937	5860	1232
Gardeners and Groundskeepers	13836	3282	1051
Systems Analysts, Electronic Data Processing	19345	7827	968
Licensed Practical Nurses	14873	4351	961
Accountants and Auditors	19361	4599	955
Maintenance Repairers, General Utility	21402	4188	900
Delivery and Route Workers	24641	4503	884
Automotive Mechanics	21715	4605	867
Managers, Restaurant or Coffee Shop (4)	12490	4028	784
Carpenters	18469	1286	776
Electrical Engineers	15878	5177	741
Receptionists (5)	11401	3193	724
Correction Officers and Jailers	7874	2573	720
Psychiatric Aides	11491	3450	709
Bus Drivers	17416	2893	691
Cooks, Institutional	12438	2641	663
Clerical Supervisors	13889	2582	640
Teachers' Aides/Educational Assistants	14514	2957	596
Cooks, Short Order and Fast Food	10399	2430	573
Computer Programmers	12776	4252	558
Bank Tellers	13209	1993	553
Electrical and Electronic Technicians	13370	4066	549
Welders and Flamecutters	14783	2781	522
Social Workers	10572	1589	502
Cooks, Restaurant	8669	2311	501
Police and Detectives	17501	2443	490
Electricians	16016	1564	482
Computer Operators	9163	3593	450
Lawyers	7061	2328	432
Hairdressers and Cosmetologists	8791	1440	427
Stock Clerks, Sales Floor	12155	2386	418
Plumbers and Pipefitters (*)	11531	1585	411
Clinical Laboratory Technologists and Technicians	6720	2102	387
File Clerks	7895	1462	387
Physicians and Surgeons	8559	2924	378
Personnel/Labor Relations Specialists (*)	10082	1421	374
Dining Room Attendants and Bar Helpers	9618	2667	366
Maintenance Mechanics	11137	1387	355
Drafters	8363	2121	333
Insurance Agents and Brokers	7623	1212	322
Librarians and Related Workers	5645	960	321
Real Estate Agents and Brokers	3632	672	321
Electric and Electronic Assemblers	6260	2027	317
Heavy Equipment Operators (*)	11485	1014	314
Painters, Maintenace	7248	652	306
Payroll and Timekeeping Clerks	6258	1070	304
Child Care Workers, except Private	3931	1223	303
Stenographers	7572	39	300
Shipping and Receiving Clerks	8457	1228	300
Order Clerks	5266	855	299
Switchboard Operators/Receptionists (5)	5280	996	298
Bartenders	5592	1202	286
Dental Assistants	4457	1685	285
Laundry and Drycleaning Operatives, not elsewhere classified	5108	953	285
Writers and Editors	5251	1238	280
Civil Engineers	5734	1330	272
School Administrators, Elementary and Secondary	5901	1021	260
Teachers, Adult Education (6)	6237	981	259
Recreation Workers	6157	1051	254
Paralegal Personnel	3151	1711	249
Machinists	6162	1059	247
Purchasing Agents and Buyers	6320	917	240

Occupational Title	Projected 1990 Employment	1980-1990 Difference	Average Annual Openings
Mechanical Engineers	5822	1460	232
Wholesalers	4404	779	231
Bookkeeping and Billing Machine Operators (3)	4764	933	229
Data Processing Machine Mechanics	3371	2154	225
Personnel Clerks	4849	688	220
Vocational and Educational Counselors (*)	4391	856	218
Construction Laborers, except Carpenters' Helpers	6010	719	218
Sales Managers, Retail Trade	5551	972	213
Clothing Ironers and Pressers	4633	640	213
Firefighting Occupations (*)	8560	1086	213
Pharmacists (7)	3873	752	208
Teachers, Vocational Education (6)	4692	781	208
Press and Plate Printers (*)	5384	1257	208
Hosts and Hostesses, Restaurant or Lounge	3569	1076	204
Flight Attendants	3754	600	203
Butchers and Meat Cutters	4692	788	198
Sheet Metal Workers	7538	675	196
Elegibility Workers, Welfare	2538	327	193
Production Clerks	5416	825	192
Mail Handlers, except Postal Service	3844	633	177
Insurance Clerks, Medical	2740	975	174
Stationary Engineering Occupations	3862	402	167
Diesel Mechanics (*)	4719	733	163
Office Machine Servicers, including Cash Register Servicers	2855	1179	157
Refrigeration and Air Conditioning Mechanics	4223	673	156
Public Administration Inspectors, except Construction	3998	554	153
Pantry, Sandwich and Coffee Makers	2634	750	152
Insurance Claims Workers	2769	866	150
Medical Assistants (*)	2225	819	150
Designers	4202	927	148
Construction Inspectors	2634	563	146
Animal Caretakers	2259	609	144
Keypunch Operators (8)	5960	-390	143
Electrical Power Line Installers and Repairers	5376	982	143
Shipfitters	3437	831	143

* Interviews were conducted for these occupations, but they were not included in the report either because the interviews yielded no evidence of changing job skills, or because there were technical problems in completing enough interviews.

1. Preschool and Elementary, and Secondary Teachers are combined in the report and listed as Kindergarten, Elementary and Secondary Teachers.
2. Professional nurses are listed as Registered Nurses in the report.
3. Bookkeeping and Billing Machine Operators are included under Bookkeepers in the report.
4. Managers of stores and restaurants are combined in the report and listed as Store or Restaurant Managers.
5. Switchboard Operators/Receptionists are included under Receptionists in the report.
6. Adult and Vocational Education Teachers are combined in the report.
7. The report includes only Hospital Pharmacists. Separate employment figures for this group are unavailable, although roughly 19 percent of all pharmacists work in hospitals.
8. Keypunch Operators are included under Data Entry Keyers in the report. Employment figures for Data Entry Keyers are unavailable.

Table 2. Largest Employing Industries for Occupations Included in the Study

Occupation	Industries (SIC Code and Title)
Accountants	893 Accounting, auditing and bookkeeping services
	910 Federal government
	920 State government
Automotive Mechanics	551 New and used car dealers
	753 Automotive repair shops
	554 Gasoline service stations
Bank Tellers	602 Commercial and stock savings banks
	612 Savings and loan associations
	614 Personal credit institutions
Bookkeepers	821 Elementary and secondary schools
	541 Grocery stores
	801 Offices of physicians
Child Care Workers	835 Child day care services
	836 Residential care
	864 Civic and social associations
Civil Engineers	891 Engineering and architectural services
	910 Federal government
	930 Local government
Clerical Supervisors	602 Commercial and stock savings banks
	806 Hospitals
	930 Local government
Clinical Laboratory Technologists and Technicians	806 Hospitals
	807 Medical and dental laboratories
	801 Offices of physicians
Computer Operators	737 Computer and data processing services
	910 Federal government
	893 Accounting, auditing and bookkeeping services
Computer Programmers	737 Computer and data processing services
	739 Miscellaneous business services
	910 Federal government
Construction Inspectors	930 Local government
	920 State government
	910 Federal government
Correction Officers	920 State government
	930 Local government
	910 Federal government
Data Entry Keyers	Information not available
Data Processing Machine Mechanics	737 Computer and data processing services
	508 Machinery, equipment and supplies wholesalers
	489 Communication services, not elsewhere classified
Drafters	891 Engineering and architectural services
	930 Local government
	373 Ship and boat building and repairing
Electrical and Electronic Assemblers	366 Communication equipment manufacturers
	362 Electrical industrial apparatus manufacturers
	367 Electronic components and accessories manufacturers
Electrical and Electronic Technicians	910 Federal government
	508 Machinery, equipment and supplies wholesalers
	506 Electrical goods wholesalers
Electrical Engineers	910 Federal government
	739 Miscellaneous business services
	891 Engineering and architectural services
Electricians	173 Electrical work - construction
	910 Federal government
	373 Ship and boat building and repairing
File Clerks	806 Hospitals
	930 Local government
	920 State government
Guards and Doorkeepers	739 Miscellaneous business services
	822 Colleges and universities
	806 Hospitals
Insurance Agents	631 Life insurance carriers
	640 Insurance brokerages and services
	633 Fire, marine and casualty insurance carriers
Librarians	821 Elementary and secondary schools
	930 Local governments
	822 Colleges and universities
Licensed Practical Nurses	806 Hospitals
	805 Nursing and personal care facilites
	801 Offices of physicians
Machinists	373 Ship and boat building and repairing
	359 Miscellaneous machinery manufacturers, except electrical
	400 Railroads
Maintenance Mechanics	910 Federal government
	282 Plastic materials and synthetics manufacturers
	211 Cigarette manufacturers
Managers, Store	541 Grocery stores
	594 Miscellaneous shopping goods stores
	554 Gasoline service stations

Occupation	Industries (SIC Code and Title)
Managers, Restaurant	580 Eating and drinking places 531 Department stores 541 Grocery stores
Mechanical Engineers	891 Engineering and architectural services 910 Federal government 366 Communication equipment manufacturers
Medical Insurance Clerks	801 Offices of physicians 806 Hospitals 802 Offices of dentists
Nurses' Aides and Orderlies	806 Hospitals 805 Nursing and personal care facilities 836 Residential care
Office Machine Servicers	508 Machinery, equipment and supplies wholesalers 769 Miscellaneous repair shops 910 Federal government
Order Clerks	508 Machinery, equipment and supplies wholesalers 806 Hospitals 514 Groceries and related products wholesalers
Paralegal Personnel	810 Legal services 910 Federal government 930 Local government
Payroll/ Timekeeping Clerks	910 Federal government 920 State government 806 Hospitals
Personnel Clerks	910 Federal government 806 Hospitals 920 State government
Pharmacists (hospital only)	806 Hospitals
Police	930 Local government 910 Federal government 920 State government
Production Clerks	910 Federal government 481 Telephone communication services 373 Ship and boat building and repairing
Psychiatric Aides	806 Hospitals
Purchasing Agents	910 Federal government 930 Local government 806 Hospitals
Receptionists	801 Offices of physicians 802 Offices of dentists 806 Hospitals
Refrigeration and Air-conditioning Mechanics	171 Plumbing, heating, air conditioning contractors 598 Fuel and ice dealers 910 Federal government
Registered Nurses	806 Hospitals 801 Offices of physicians 805 Nursing and personal care facilities
Secretaries	910 Federal government 821 Elementary and secondary schools 810 Legal services
Shipfitters	373 Ship and boat building and repairing 910 Federal government
Shipping and Receiving Clerks	531 Department stores 508 Machinery, equipment and supplies wholesalers 514 Groceries and related products wholesalers
Stenographers	822 Colleges and universities 920 State government 910 Federal government
Systems Analysts, Electronic Data Processing	910 Federal government 737 Data processing and computer services 739 Miscellaneous business services
Teachers, Adult and Vocational Education	821 Elementary and secondary schools 910 Federal government 823 Libraries and information centers
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Selected Bibliography

"Academic Preparation for the World of Work." THE COLLEGE BOARD, 1984.

Andrews, A. James,. "Outlook Bright For Systems Analysts." PROFILE OF THE SYSTEMS PROFESSIONAL—SALARY/ACTIVITIES, (n.d.).

"The Assorted Soldiers in the Computer Army." OCCUPATIONAL OUTLOOK QUARTERLY 25 (Summer 1981): 13-22.

Ayres, Robert and Miller, Steve. "Industrial Robots in the Line." TECHNOLOGY REVIEW, May/June 1982, pp. 35-46.

Barol, Bill. "The High-Tech Payoff." NEWSWEEK ON CAMPUS, March 1984, pp. 4-8.

Barton, Paul E. "Retooling the Workforce." VOCED 58 (October 1983): 22-24.

BASIC SKILLS IN THE U.S. WORK FORCE: THE CONTRASTING PERCEPTIONS OF BUSINESS, LABOR, AND PUBLIC EDUCATION. New York: Center for Public Resources, February 1983.

Basta, Nicholas. "Job Prospects for E/E Engineers." GRADUATING ENGINEER, September 1984, pp. 174-175.

Bright, James R. "Does Automation Raise Skill Requirements?" HARVARD BUSINESS REVIEW 36 (July/August 1958): 85-98.

Brand, Horst and Huffstutter, Clyde. "Productivity in Making Air Conditioners, Refrigeration Equipment, and Furnaces." MONTHLY LABOR REVIEW 104 (December 1984): 11-16.

Braddock, Douglas. "Engineers—Higher than Average Risk of Obsolescence?" OCCUPATIONAL OUTLOOK QUARTERLY 27 (Summer 1983): 9-11.

Braddock, Douglas. "The Job Market for Engineers: Recent Conditions and Future Prospects." OCCUPATIONAL OUTLOOK QUARTERLY 27 (Summer 1983): 2-8.

BRIDGING THE SKILLS GAP: WOMEN AND JOBS IN A HIGH TECH WORLD. Washington D.C.: Wider Opportunities for Women, Inc., April 1983.

Burford, Anna Marie. "Developing Trends in Office Technology and Career Paths as Related to the Office of the Future. THE DELTA PI EPSILON JOURNAL 23 (January 1981): 19-29.

Burkholder, William J., Jacobs, Jay D., and Cameron, Bernard J. "School-Industry Cooperation: Making it Work." PUBLIC EDUCATION IN VIRGINIA 20 (Winter 1984): 10-12, 21.

Bumstead, Richard. "Opening Up High Technology Careers to Women." OCCUPATIONAL OUTLOOK QUARTERLY 25 (Summer 1981): 26-31.

"Careers in Teaching: Brighter Days Ahead." CHANGING TIMES 38 (October 1984): pp. 53-56. "Careers '85: National Employment Report." Special supplement to THE NEW YORK TIMES. October 14, 1984.

Carlucci, Frank C. "Wanted: More People With Technical Skills." DEFENSE, January 1983, pp. 11-16.

Cetron, Marvin and O'Toole, Thomas. ENCOUNTERS WITH THE FUTURE: A FORECAST OF LIFE IN THE 21ST CENTURY. New York: McGraw-Hill Book Company, 1982.

Choate, Pat. RETOOLING THE AMERICAN WORK FORCE. Washington, D.C.: Northeast-Midwest Institute, 1982.

Ciampa, Dan. "The Impact of Computer Integrated Manufacturing: the Changes on the People Side." VITAL SPEECHES OF THE DAY, June 15, 1984, pp. 534-539.

Committee on Personnel Requirements for an Advanced Shipyard Technology of the Maritime Transportation Research Board and Commission on Sociotechnical Systems, National Research Council. PERSONNEL REQUIREMENTS FOR AN ADVANCED SHIPYARD TECHNOLOGY. Washington D.C.: National Academy of Sciences, 1980.

Commonwealth of Virginia, Department of Education, Division of Instructional Media and Technology. GUIDELINES FOR EDUCATIONAL COMPUTING IN VIRGINIA. Richmond: 1984.

Commonwealth of Virginia, Department of Education, Task Force on Vocational Education for Economic Growth. VOCATIONAL EDUCATION: MAKING IT WORK. Richmond: 1985.

Commonwealth of Virginia, Department of Planning and Budget, Economic Research Section. COMMONWEALTH OF VIRGINIA: DEMOGRAPHIC AND ECONOMIC TRENDS. June 1978.

Cornish, Edward, (ed.). CAREERS TOMORROW: THE OUTLOOK FOR WORK IN A CHANGING WORLD. Bethesda, Maryland: World Future Society, 1983.

DeVore, Paul. "1981 and Counting." VOCED 56 (March 1981): 29-31.

Dillich, Lisa S. "The Job Market for Teachers in the 80's: Signs of Improvement ... Charting the Course." OCCUPATIONAL OUTLOOK QUARTERLY 24 (Fall 1980): 22-27.

Drucker, Peter F. "A Growing Mismatch of Jobs and Job Seekers." THE WALL STREET JOURNAL, March 26, 1985.

Eckstein, Albert J. and Heien, Dale M. "Causes and Consequences of Service Sector Growth." GROWTH AND CHANGE 16 (April 1985): 12-17.

Eder, Peter F. "Telecommuters: The Stay-at-Home Work Force of the Future." THE FUTURIST 17 (June 1983): 30-32, 34-35.

Ehrbar, A. F. "Grasping the New Unemployment." FORTUNE, May 16, 1983, pp. 107-112.

Ehrenhalt, Samuel M. "No Golden Age for College Graduates." CHALLENGE, July/August 1983, pp. 42-50.

"Engineering ed. lacks breadth, study reveals." SPOTLIGHT 7 (June 1985): 1-3.

"Focus: Technology, People and Work." MANAGEMENT WORLD, October 1982, pp. 21-23.

Greenbaum, Joan M. IN THE NAME OF EFFICIENCY: MANAGEMENT THEORY AND SHOPFLOOR PRACTICE IN DATA-PROCESSING WORK. Philadelphia: Temple University Press, 1979.

Griffin, Alison. "Varina Project Features 'Electronic Classroom.' " PUBLIC EDUCATION IN VIRGINIA 20 (Fall 1984): 8-9, 21.

Griffin, Alison. "Adult Education: A Second Chance." PUBLIC EDUCATION IN VIRGINIA 21 (Spring 1985): 1-7.

Grossman, Ilene and Hannaford, Wendell, (eds.). EMPLOYMENT IN THE 1980S: JOBS FOR A CHANGING ECONOMY (Speeches from a conference co-sponsored by the Eastern Regional Conference Economic Affairs Task Force and the Midwestern Conference Business Development and Education Task Forces). Boston, Massachusetts, May 6-7, 1983, 28-32.

Hemphill, W. Edwin; Schlegal, Marvin W.; and Engelberg, Sadie E. CAVALIER COMMONWEALTH: HISTORY AND GOVERNMENT OF VIRGINIA, 2nd edition. New York: McGraw-Hill, 1963.

HIGH SCHOOLS AND THE CHANGING WORKPLACE: THE EMPLOYER'S VIEW. Report of the Panel on Secondary School Education for the Changing Workplace. Washington, D.C.: National Academy Press, 1984.

"High Tech Career and Employment Opportunities." Special supplement to THE WASHINGTON POST, October 7, 1984.

Hoffman, Joan. "Streamlining Bank Training to Meet the Challenges of the 80s." BOTTOMLINE 1 (June 1984): 29-32, 64.

Holmes, Peter A. "1984-85 Economic Forecast: Surge in Consumer Spending, Business Investment and Jobs." NATION'S BUSINESS, January 1984, pp. 20-25.

Howard, H. Philip and Rothstein, Debra E. "Up, Up, Up, and Away: Trends in Computer Occupations." OCCUPATIONAL OUTLOOK QUARTERLY 25 (Summer 1981): 3-11.

Howard, H. Philip and Rothstein, Debra E. "Input for Computer Workers: Education and Training for Computer Occupations." OCCUPATIONAL OUTLOOK QUARTERLY 25 (Summer 1981): 23-25.

Hubbart, William S. "The Danger of 'De-Skilling''OA Personnel." OFFICE ADMINISTRATION AND AUTOMATION 45 (March 1984): 35-37, 93.

Hull, Daniel M. and Pedrotti, Leno S. "Meeting the High Tech Challenge." VOCED 58 (May 1983): 18-31.

Hunt, H. Allan and Hunt, Timothy L. HUMAN RESOURCE IMPLICATIONS OF ROBOTICS. Kalamazoo, Michigan: W.E. Upjohn Institute for Employment Research, 1983.

"Jobs and Technology." THE ECONOMIST, March 24, 1984, pp. 71-72.

"Jobs of the 1990's." FORTUNE, May 16, 1983, pp. 116-123.

Katzman, Marvin S. "When Robots Dominate the U.S. Workplace." SUPERVISORY MANAGEMENT 28 (June 1983): 37-42.

Kirkland, Richard I., Jr. "Are Service Jobs Good Jobs?" FORTUNE, June 10, 1985, pp. 38-43.

Knez, Robert J. "Sharing Human Intelligence Through a Computer Network." DEFENSE MANAGEMENT JOURNAL, Ist Quarter, 1983, pp. 43-44.

Krulwich, Sara Natalson. "Job Projections Evaluated by Education or Training Requirements." LOOKING AHEAD 8 (February 1985): 8-10.

Levin, Henry M. EDUCATION AND JOBS IN A TECHNOLOGICAL WORLD. Columbus, Ohio: The National Center of Research in Vocational Education, 1984.

Levin, Henry and Rumberger, Russell. "The Low Skill Future of High Tech." TECHNOLOGY REVIEW, August/September 1983, pp. 18-21.

Main, Jeremy. "Work Won't Be the Same Again." FORTUNE, June 18, 1982, pp. 58-65.

Martin, Gail M. "Industrial Robots Join the Work Force." OCCUPATIONAL OUTLOOK QUARTERLY 26 (Fall 1982): 2-11.

Martin, Gail M. Medical Technology of the 1980's: Giving Birth to New Health Careers." OCCUPATIONAL OUTLOOK QUARTERLY 26 (Winter 1982): 2-12.

Martin, Gail M. and Fountain, Melvin C. "Matching Yourself with the World of Work." OCCUPATIONAL OUTLOOK QUARTERLY 26 (Winter 1982): 2-12.

Martin, James. TELEMATIC SOCIETY: A CHALLENGE FOR TOMORROW. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1981.

Mitchell, Joyce Slayton. YOUR JOB IN THE COMPUTER AGE: THE COMPLETE GUIDE TO THE COMPUTER SKILLS YOU NEED TO GET THE JOB YOU WANT. New York: Charles Scribner's Sons, 1984.

Molnar, Andrew R. and Babb, Patricia W. "The Electronic Age Challenges Education." APPALACHIA 16 (November-December 1982): 1-7.

Morf, Martin. "Eight Scenarios for Work in the Future." THE FUTURIST 17 (June 1983): 24-29.

Nardone, Tom. "Looking at the Future." OCCUPATIONAL OUTLOOK QUARTERLY 28 (Fall 1984): 14-19.

Neal, Dorothy A. "What Will Office Procedures Training Be After 1984?" BUSINESS EDUCATION FORUM 38 (April-May 1984): 35-39.

Noyelle, Thierry J. "Rethinking Public Policy for the Service Economy with a Special Focus on People and Places." LOOKING AHEAD 8 (July 1984): 1-7.

O'Connell, Joan M. "There Really Are Jobs After Retraining." BUSINESS WEEK, January 28, 1985, pp. 76-77.

Olson, Lawrence. "Training for a Transformed Labor Market." TRAINING AND DEVELOPMENT JOURNAL 37 (March 1983): 46-53.

Pitts, Bill. "What Effects Will Computer Technology Have on You?" THE URBAN LEAGUE REVIEW 8 (Winter 1984): 68-76.

Port, Otis. "Where Will the Jobs Be?" BUSINESS WEEK'S GUIDE TO CAREERS, (n.d.).

"Preferred Employee Attributes." JOURNAL OF COLLEGE PLACEMENT. Spring 1985, pp. 53-54.

"Revitalizing Vocational Education." PUBLIC EDUCATION IN VIRGINIA 21 (Spring 1985) 1: 17-19.

Rhodes, Frank H. T. "The Role of the Liberal Arts in a Decade of Increased Technology: An Enduring Value for Six Reasons." VITAL SPEECHES OF THE DAY 1 (June 15, 1984): 532-534.

Riche, Richard W. "Impact of New Electronic Technology." MONTHLY LABOR REVIEW 105 (March 1982): 37-39.

Riche, Richard W., Hecker, Daniel E., and Burgan, John U. "High Technology Employment: Fast Growth But Few Jobs." OCCUPATIONAL OUTLOOK QUARTERLY 28 (Spring 1984): 31-36.

Rosenthal, Neal. "Machinist Shortage—A Look at the Data." OCCUPATIONAL OUTLOOK QUARTERLY 26 (Fall 1982): 15-19.

Rozen, Miriam. "Wanted: High-Tech Engineers." DUN'S BUSINESS MONTH. March 1985, pp. 35-36.

Rumberger, Russell W. "The Changing Skill Requirements of Jobs in the U.S. Economy." INDUSTRIAL AND LABOR RELATIONS REVIEW 34 (July 1981): 578-590.

Sekscenski, Edward S. "The Health Services Industry: A Decade of Expansions." MONTHLY LABOR REVIEW 104 (May 1981): 9-16.

Schiff, Frank W. "Flexiplace: Pros and Cons." THE FUTURIST 17 (June 1983): 32-33.

Sherman, Susan W., ed. EDUCATION FOR TOMORROW'S JOBS. Washington, D.C.: National Academy Press, 1983.

"Spring Guide to Career and Job Opportunities." Special supplement to THE WASHINGTON POST, April 28, 1985.

"Study Reports Job Skills Important for High School Grads." CAREER OPPORTUNITY NEWS 1 (December 1984): 8.

Thomas, Edward. "Committee of 500 Report: Trends in Qualifications of Office Employees." MANAGEMENT WORLD 9 (July 1980): 15-16.

United States Congress, Office of Technology Assessment. COMPUTERIZED MANUFACTURING AUTOMATION: EMPLOYMENT, EDUCATION, AND THE WORKPLACE. Washington, D.C.: U.S. Congress, OTA-BP, CIT-11, February 1982.

United States Department of Labor, Bureau of Labor Statistics. OCCUPATIONAL OUTLOOK HANDBOOK. Bulletin 2205. April, 1984.

United States Department of Labor, Bureau of Labor Statistics. OCCUPATIONAL PROJECTIONS AND TRAINING DATA. Bulletin 2206. May, 1984.

Virginia Employment Commission, Research and Analysis Division. VIRGINIA 1990 OCCUPATIONAL EMPLOYMENT PROJECTIONS. March, 1985.

Weiss, Alan Jay. "The Revolution Around Us." TRAINING 20 (June 1982): 42-43, 46-47.

Wharton, Andrea. "Wanted: WP Operators." TODAY'S OFFICE 17 (February 1983): 21-22.

"Will There Be Manufacturing Jobs in America's Future?" CAREER OPPORTUNITY NEWS 2 (March-April 1985): 1.

Williams, Bob and Eckblad, John. "Office of the Future: Implications of High Technology." ACCOUNTANCY, September 1983, pp. 85-86, 89-90.

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